PRIMARY (JUNIOR) TEACHING TODAY

NATURE STUDY AND SIMPLE SCIENCE

A. ALLCOTT, B.Sc.

PAINTING AND PICTURE-MAKING

N. S. LASENBY

WEAVING AND SPINNING ACTIVITIES

R. K. POLKINGHORNE, B.A. (LOND.)
M. I. R. POLKINGHORNE, B.A. (LOND.)

CLAY MODELLING AND CARVING

SEONAID M. ROBERTSON, D.A. (EDIN.), Academic Diploma in Psychology (LOND.)

FREE ACTIVITIES

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FOR USE WITH NATURE STUDY AND SIMPLE SCIENCE SECTION

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NATURE STUDY AND SIMPLE SCIENCE

CHAPTER ONE

INTRODUCTION

NATURE STUDY is frequently regarded as simply the study of living things, of animals, insects, flowers, and trees. To the adult mind, with a background of experience, this may be satisfactory and sufficient as a chosen form of leisure pursuit.

Young children, however, have no such mental background, and to them all things are new. The form and activities of living creatures, or the glory of the flowers, may thrill and delight them, but the change of season, heat and cold, fires and lights, the wonders of the heavens and physical facts and properties generally also provide new fields of research to the young inquirer.

Hence in our schools a wide interpretation must be given to the term Nature Study. The spirit of investigation must be ever present, and means must be found to satisfy the natural curiosity of the child.

The success of the course will be measured by the extent to which the children are inspired to become true seekers after knowledge. "What is it? What does it do? How does it work?" and to a much smaller extent, "What is the reason for it?" are the questions which must be answered.

The syllabus must be the servant and not the master of the teacher. Logical order is much less important than sustained interest. The state of speculative wonder of the child's mind should be exploited in such a way that science lessons are awaited with interest. If the teacher is the guide to the beauties and wonders of Nature's work and to the romance of man's attempts to solve her mysteries, the science course will be full of interest and will have a distinct cultural value.

An outline of a scheme based on these lines is given for the guidance of the teacher. For ease of reference the syllabus for each year has been arranged under three heads; Animal Study, Plant Study, and Related Science. It is not intended, however, that the lessons should be taken in this order. The sequence will depend on many factors, such as locality, season, availability of material, and the desires of the teacher and the children.

Some suggestions as to sequence are made in the fuller notes which follow the scheme.

The Teacher's Part

Although it is desirable that Nature Study should be under the control of

a specialist, lack of expert knowledge need deter no teacher who has had a good grounding in scientific principles from undertaking the congenial task of interesting children in Nature's marvels.

The teacher who is a keen lover of Nature will gain both pleasure and profit from the preparation of the lessons. No doubt in the beginning these preparations will entail some call on leisure-time, but the true Nature lover will not grudge this and will look upon the time spent as relaxation.

Many of us who have always enjoyed in a general way the beauties of the countryside find new marvels and greater interests when we begin to observe these things with an eye to the acquisition of knowledge and material for our lessons. Our scientific training helps us in consulting the right books and in correlating with our own observations the information gained therein. Our rambles in the country become more frequent and more purposeful, and even in odd corners of our towns and cities we find new sources of scientific interest, be these only the lichen on the tombstones or the straggling plants bravely fighting for existence on a neglected building site.

The teacher with some skill in craftsmanship has the advantage of being able to make and improvise apparatus. Failing this aptitude, a diplomatic approach to the teacher of handicraft will be productive. If the teacher can also gain the confidence of the schoolkeeper and interest him in the exhibits such as aquaria, insect-cages, etc., the provision and keeping of material will be made easier.

The children should participate in as many of the experiments as possible. The more they are given to do the better will they enjoy the lessons. Even experiments demonstrated by the teacher will go better if one or two children are called on to act as assistants.

Scheme of Four Years' Course

First Year. Age 7+.

Animal Life

Cat, dog, horse, donkey, rabbit, form and habits, intelligence, animal stories, episodes, etc.; goldfish, stickleback, minnow, how a fish breathes, gills, scales, fins.

Tadpoles and frogs: life-history of the frog.

Common birds: habits, feeding, song, nests and eggs, migration; sparrow, starling, blackbird, gull, thrush, robin, cuckoo, pigeon, swallow, martin, swift.

Plant Life

Flowers: colour and form, naming common flowers, making daisy chains, etc., flower collections, drawing and colouring flowers; bees and pollen.

Trees in summer and winter: their form and branching, shapes of leaves, twig collection, blossoms and fruits; evergreens, things we get from trees, the winter sleep (plants and animals) and the spring awakening.

Related Science

Sunshine and warmth, light and shade, sunrise and sunset, the cardinal points, the changing altitude of the sun, the sun a star, mythical tales about the sun, sunbeams and beams of artificial light, shadows, hand-shadows, raindrops, clouds, wind, frost, ice, and snow.

Second Year. Age 8+

Bird Life

Birds and their young, comparison of bird's egg and seed of plant, nests and nest building; nidicolous and nidifugous birds; types of eggs, parental care, siting of nests and other methods of parental protection; hatching, feeding, beaks and claws of birds, habits, migration.

Insect life: the house-fly, its life-history; what is an insect? Flies and disease.

Plant Life

The parts of a flower, calyx, sepals, petals, stamens, stigma, ovary; the birth of the seed, reproduction, twigs and buds of trees, examination of horse-chestnut bud, the arrangement of buds on twigs, keeping a blossom diary; leaves (simple and compound), form and veining, skeleton leaves, vein prints, leaf and leaflet, the young leaf in the bud, leaf scars; evergreens and deciduous trees.

Related Science

The motion of the earth, mythical tales, Copernicus, Galileo; real and apparent motion; the relation of the earth to the sun; the earth's axis, north and south poles; reasons for day and night; the moon as an object in the night sky, waxing and waning, the man in the moon; the mariner's compass and the cardinal points; fog and its relationship to dust and moisture, water-dust, breath, steam, dust prevention; burning, air necessary for combustion, chimneys and ventilation; fresh air and its virtues; sand and clay, comparisons, permeability and capillarity in sand and clay; choice of housing sites; plant life and soil tillage in relation to sand and clay. (Many of these topics help the second year's work in geography. It is very valuable for the child to hear the same thing from different points of view. See Geography, Volume III.)

Third Year. Age 9+

Insect Life, etc.

Butterflies and moths; life-history of insects; examination of eggs, caterpillars, pupæ, imago, silkworm; breeding of moths in insect-cages; parasites of plants and animals, ichneumon fly, codling moth, apple sawfly, etc.; beetles and other insects; the earthworm, making a wormery, worm-casts, reproduction in the earthworm, what the worm does to the ground.

Plant Life

Food from the soil, study of soil, sand, clay, chalk, humus, kinds of soil, separation of soil into its main constituents, soil experiments; simple biology of the plant, functions of root, stem and leaves; fruits: plum, apple, strawberry, raspberry, pea, bean; blossom, fertilization, root pressure, transpiration; how manure acts, the food-stores of plants, the edible parts of plants, common vegetables.

Related Science

Moon as a satellite, moonlight, phases, month, planets, stars, some well-known constellations, the milky way, simple talks on telescope, astronomy, observatories; time, shadows, sundial, hour-glass and early clocks, Galileo and pendulum. (This works in with History Syllabus). Heat and temperature, thermometers, body temperature, conduc-

tion and radiation; effects of heat, melting and dissolving, boiling, evaporation, condensing: clouds, rain and winds, wind rose: simple study of weather science.

Fourth Year. Age 10+

Animal Life, etc.

Spiders and their comparison with true insects; bees, wasps, and ants; house-fly (revision and extension); gnats, mosquitoes, dragon and caddis flies; warm- and cold-blooded animals, reptiles, rodents, rabbit, hare, rat, mouse, squirrel, dormouse; control of pests and prevention of epidemics; animals of the farm—hoofed animals, horse, sheep, cow; milk, clean milk, bacteria, care of household milk.

Plant Life

Sprouting seeds, the baby plant in the seed, carbon dioxide and oxygen, germination, carbon assimilation in plants, how plants help to keep the air pure, how animals and plants help each other, starch and sugar, tests with iodine; scattering of seed, plant parasites and bacteria; mistletoe, toadstool and mushroom, spores, mildew, yeast.

Related Science

Heat, expansion and contraction, convection, freezing, bursting of water-pipes; glaciers and icebergs; light, incandescence, artificial light, camera, eye, colour, spectrum, rainbow; sound, vibration of tuning-fork and stretched wire, conduction of sound, speed of sound and speed of light, echoes; electricity, examination of electric torch, conduction, circuits, switches, electric bulbs, light and heat from electricity, the power station and the grid; burning and breathing, burning of candle, production of carbon dioxide, carbon dioxide and lime-water, oxygen, and nitrogen, nature of air; Priestley, Lavoisier and the discovery of oxygen.

CHAPTER TWO

MATERIALS, SUGGESTIONS, AND ACTIVITIES FOR FIRST YEAR'S WORK

IN some ways this is the most difficult part of the syllabus. The children have no extensive background of experience, and few of them, unaided, are able to gather information from books except by looking at pictures.

For very young children, indoor Nature Study is at the best but a poor substitute for the enlargement of their experience by actual contact with Nature itself. One feels that they should be running about, under wise and unobtrusive guidance, in the open air, gathering flowers or fruits, peering into ditches and holes in tree trunks, watching the gambols of the lambs and the activities of the rabbits.

On the other hand, with their unsophisticated minds they present virgin ground for the teacher to cultivate. Their interests are easily aroused, they are ever eager for new experiences, and answers to their queries are usually accepted without reserve.

Being still in the fairy-tale stage, they are always ready, and even anxious, to be thrilled by revelations that might leave older children unmoved.

Too much teaching at this stage is undesirable. It is sufficient to awaken the children's interest in Nature and to allow them to absorb what knowledge they can. There need be no rigorous order of syllabus, but the subjects of lessons may be chosen according to season, convenience, and availability of material.

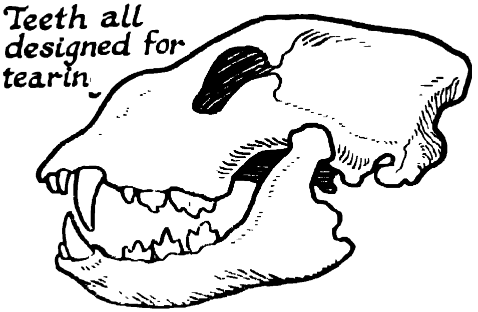
I. Animal Life

The Cat

Required: Cat or kittens; saucer of milk; bone with a little meat on. Pictures of lions, tigers, and other members of the cat tribe (see Plate I).

Start preferably with a fully-grown cat; it is more sedate than a kitten and more suited to observation, as being more likely to keep still. Talk about its fur coat and watch the cat at its toilet. If the cat is allowed to lick a drop of milk from the child's hand, the roughness of the tongue is demonstrated; the tongue serves as brush and comb, and is also useful to lick the meat from a bone. The tongue is used to clean all parts of the body but the head. How is the head cleaned? Tongue is also used to lap up milk, etc.

Examine the paws, count the toes, note the cushion-like pads underneath, also the retractile claws, curved and sharp. The pads make for silent approach, and the claws serve to seize prey, assist in climbing, and even sometimes in digging.



SKULL OF CAT.

The teeth are all designed for tearing, thirty teeth in all, no molars or chewing teeth. (Actually the last two teeth in the upper jaw are molars, but are so small as to be useless for chewing.) The cat does not chew, but tears its food into small pieces and bolts it. Let children examine their own teeth. A cat cannot chew, but a child can and must. Examine the eyes, note the slit-like pupil; by drawing curtains or switching off lights, allow the children to see how this slit nearly closes in a strong light and opens more widely as the light fades. Can a cat see in the dark? The answer is that no living creature can see in the dark. The eyes of a cat, however, are designed to make use of even the most feeble light, and so the cat can see better than we can in a very dim light. In a strong light the pupil contracts and shuts off most of the light which might otherwise prove too strong for the sensitive eye.

Incidentally, the cat, in common with most animals, is colour blind, and sees objects only in black and white; but it is wiser not to attempt to explain this to young children.

The cat's whiskers help the animal when roaming in the darkness. Here the sense of touch and not of sight comes in. Demonstrate by touching the hairs on the back of the hand with a match or the edge of a postcard; a tickling sensation is noticed.

The cat is a hunter, its strength, speed, and agility in jumping or climbing should be noted. Other members of the cat tribe are lion, tiger, leopard, jaguar, lynx, and wild cat (see first year's work, GEOGRAPHY, Volume III). Note similarities of build and habits; cats purr when contented, so do lions and tigers.

Watch a kitten at play; why does he chase balls of paper and cotton-reels? In playing he is developing his muscles and gaining experience. Later he may want to chase mice and other forms of prey.

Children's Activities

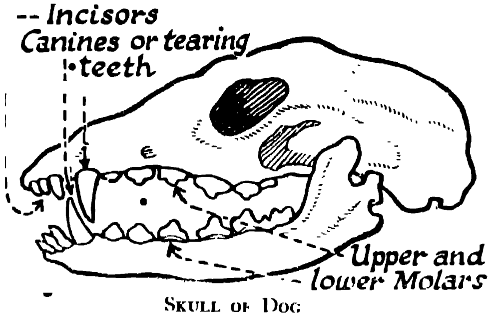
(1) New words learnt: pupil of eye, molar, prey, retractile, muscles.

(2) Collect pictures of cats of different breeds and colours. Tortoiseshell, Persian, Siamese, black, white, etc. These could be put into a brown-paper book or in a panorama book (see ENGLISH, Volume I).

(3) Each child to make a booklet about cats, illustrated with pictures cut from magazines, etc.

(4) Write a story about a day in the life of your own cat.

(5) Children enjoy looking at Plate 1, Animals of the Cat Tribe. They will want to know something about each animal. Encourage them to find out some facts for themselves from easy books about animals in the class, school, or Free Library. In the geography lessons they find out where these animals live. (See especially Chapter VII, GEOGRAPHY, Volume III.) Plate I is also useful for descriptive work in the English lesson; for example, by looking at the lion they realize the meaning of the word "tawny." (See Chapter VI, ENGLISH, Volume I.)



SKULL OF DOG

THE DOG

Required: Live dog; pictures of dogs.

Ask children to guess how many toes a dog has; then let them count for themselves. The dog has five toes on each fore paw and four on each hind paw. Claws are non-retractile; the dog uses its mouth for seizing prey.

There are 42 teeth: 6 incisors or cutting teeth, and 2 canines or tearing teeth, in each jaw. In addition there are 12 molars in the upper and 14 in the lower jaw. Note how a dog uses the molars to crunch a bone.

The eye-pupil is round; probably a dog depends much more on scent and hearing than on sight. Note the smooth tongue, always wet; a dog perspires only from its tongue and not from the surface of the body. Hence the open mouth and hanging tongue after exercise or on a hot day.

Demonstrate the keen sense of smell by telling the young owner to hide and then setting the dog to find him, or by telling the dog to seek some object hidden by the owner. Avoid confusing the scent by passing the object from hand to hand.

Talk about dog's intelligence, fidelity, and love of his master. Stories of faithful and clever dogs will be useful here; for example, Gelert, the dogs of Mont St. Bernard, etc.

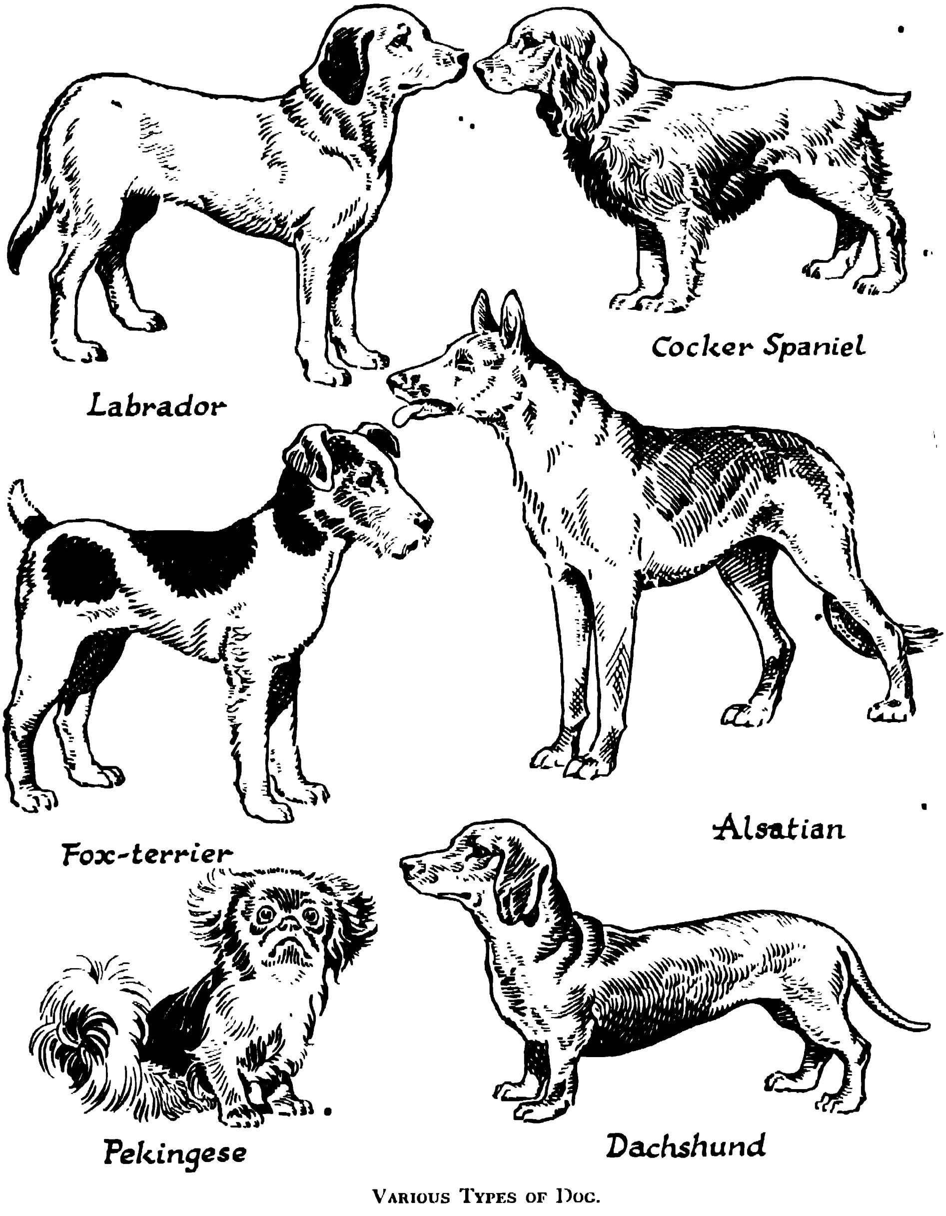
Trained dogs, patience and kindness needed in training. The dog learns by repetition and is rewarded when he succeeds. The dog is the friend and companion of man, and has been so for thousands of years. Man uses dogs of different breeds to help him in various ways.

The *sheepdog* is intelligent and faithful; he appears to understand sheep almost as well as his master. He obeys his master's voice and whistle and can quickly round up a large flock of sheep and drive them through gates without letting one escape. He barks to frighten back escaping sheep, but never bites them. The sheepdog puppy begins early to learn from his parents and may amuse himself by rounding up all the poultry in the farmyard. When he is older, his master takes him out and trains him. Any teacher who has seen sheepdog trials in Cumberland or Wales has plenty of material to interest the children.

Police dogs are large dogs trained to protect houses and to help the police in capturing criminals. They are trained to hold a man without injuring him.

The *bulldog* was originally called a butcher's dog and was used to catch

SHEEPDOG.



VARIOUS TYPES OF DOG.

cattle by seizing them by the nose or lip. Later they were used for bull-baiting and were purposely encouraged to be fierce. As time went on they became more tame, and today most bulldogs are good-tempered.

Hounds of different kinds are used for hunting foxes, stags, otters, etc. These have a keen sense of smell and hunt entirely by scent. Greyhounds, however, are bred for speed and hunt by sight.

The *Newfoundland* dog is a strong swimmer, and there are many cases of this breed saving people from drowning.

Terriers are small dogs originally designed for digging out foxes or other game, or for following them down holes, etc. They are usually intelligent and easily trained. The blind man's dog is frequently a terrier.

Children's Activities

(1) Describe how a dog digs. Which feet does he use for digging?

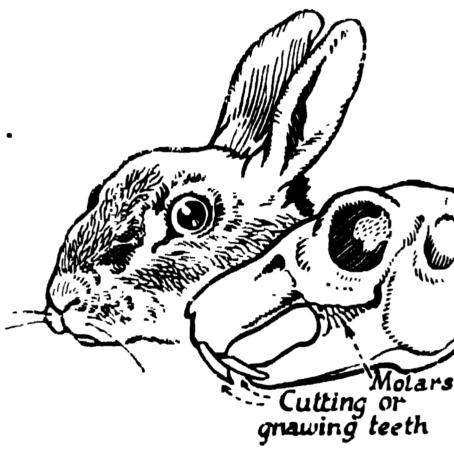
(2) Make a list of as many kinds of dogs as possible. Underline and describe all those you have seen.

(3) Make a booklet about dogs. (See English, Volume I.)

(4) Compare the dog and cat: a cat has soft *fur*, a dog *hair*, and so on.

Other Domestic Animals

The rabbit, donkey, horse, and cow may be dealt with superficially in the first year, but it is better to leave a fuller study until later. To avoid disappointing a child who wishes to bring a pet rabbit to school, the superficial and obvious features may be observed. The furry body, long ears, teeth, and split upper lip. Long ears to collect sound and give warning of approaching enemy. Longer hind legs than fore legs, hence hopping method of progression. Hair instead of pads under feet gives a firm grip on rocks or slippery ground. The rabbit is timid and usually seeks safety in flight. Strong cutting or gnawing teeth in front; no canines, as rabbit is a vegetarian; 22 molars and premolars. The front gnawing teeth are always growing, and wear down as the animal gnaws. The split upper lip can be lifted out of the way, when gnawing bark from trees. The



Head and Skull of Rabbit.

white patch under the tail may not be evident in a tame rabbit, but is always present in the wild one. This is said to act as a guide to the young following behind; there appears, however, to be some doubt about this.

Children's Activities

(1) Describe any pet you have and say what it can do.

(2) Make a booklet about pets.

(3) Make a list of all the kind ways in which you should treat your pets, and another list of things you should not do.

(4) Make an ABC booklet of four-legged animals. You know a good many already to put in—tiger, lynx, jaguar, etc. Try to find at least one for every letter.

(5) New words for Word Book: *incisors, canine teeth, vegetarian, gnaw*, etc.

Fishes

Required: A bowl of goldfish, or any live fish in an aquarium; a whole herring or a cod's head from a fish-shop. Pictures of fishes (see Plate II, Stickleback and Nest).

Watch the goldfish in a bowl; they appear to be always opening their mouths as if drinking. Now explain that the water going into the mouth is not swallowed but passes out by the gill slits. Talk about gills. Show the gill covers on a dead fish. Lift these and show the gills underneath. What do we need for breathing? We need air, so does the fish. There is some air in the water. As the water passes over the gills the air it contains is breathed in by the fish. We breathe through our noses, the fish breathes through its gills.

Why must the water in the bowl be changed? Partly to get rid of dirt, but chiefly because the air in the water is soon used up.

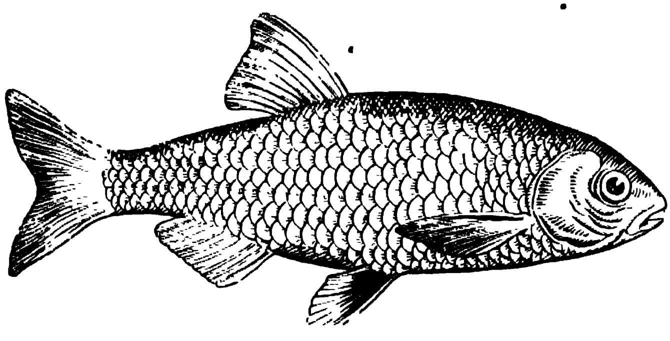
When fishes continually come to the top with open mouths, it is a sign that the water is getting short of air. The water at the surface, in contact with the air, is always likely to be richer in dissolved air.

A fish may live out of water for some time, so long as the gills are wet. The moisture on the gills does not contain much air, but being in contact with the atmosphere quickly dissolves more. Live goldfish are sometimes sent through the post, packed in wet moss.

Explain how the water should be changed. It should be drawn beforehand and left for an hour in the same room as the bowl, so that it attains the same temperature.

Notice the scales (dead fish) overlapping like the tiles on a roof. What other living things have scales? Compare snakes, crocodiles, and the legs of birds. Call attention to the fins. The large one on the back and the smaller ones underneath and at the sides. Compare the side fins with arms, also with oars as used for rowing. The top and bottom fins are used chiefly to balance the fish. Sometimes the large top fin suffers from mildew and may be partly destroyed, in which case the fish has difficulty in keeping its balance and tends to roll over on its side. Although the side fins are used for swimming, the large tail fin is the chief means of propulsion. Some children may have seen a boatman put an oar over the stern of his boat and by moving it from side to side with a screwing motion send the boat along. If so, they will appreciate the use of the tail fin in swimming. The tail fin is also used as a rudder. Well-known small fishes likely to be seen in ponds and streams may be mentioned: the minnow, miller's thumb, and stickleback.

Children will like to hear the story of the stickleback. In late spring the underside of the throat and belly of the male fish takes on a bright-red colour, hence the alternative name, red throat. He builds a nest, shaped like a barrel without ends lying on its side. This is made of grass and weeds cemented in



FISH, SHOWING SCALES AND FINS.

place with slimy matter from his mouth. The nest is about one-third as long as the fish. When this is ready he coaxes and bullies a female fish until she enters the nest and lays a bunch of tiny yellow eggs. The stickleback appears to be polygamous, for this process is repeated with other females, all of whom swim away after depositing the eggs. The male then enters the nest to fertilize the eggs with milt from his body, afterwards tucking them well down on the bottom. The eggs take three weeks to hatch, and during this time the male stickleback tends the nest, using his fins frequently to send a stream of fresh water over the eggs and removing with his mouth any dirt that lodges in the nest. He also drives away intruders and guards the baby fish when they hatch out. These are at first nearly transparent and almost rectangular in shape, but as their spines grow they gradually assume a fish-like shape.

No doubt the children will want to talk about other fishes with which they are familiar. It will be well if they can be led to think more about fishes in ponds and streams than in captivity, and to realize that the lot of a goldfish in a bowl is dull compared with the more adventurous and exciting life of the natural environment.

Children's Activities

(1) Look carefully at the coloured picture of the stickleback and its nest. Draw a picture of it from memory, and write in good sentences all that you remember about the fish and its nest.

(2) Draw a part of a fish to show how the scales lap over one another. Then draw the tiles of a roof.

(3) Draw a goldfish or stickleback. Notice how the body and head come to a point. This helps the fish to cut through the water. (See HISTORY, Volume II, which tells how men copied the fish and swimming birds when they *shaped* their first boats.)

(4) Make a list of all the fish you know and write one or two sentences about each.

(5) Find out the names and some facts about all the little creatures on Plate II.

TADPOLES AND FROGS

Required: Large diagrams to show the stages in the life-history of the frog. Live tadpoles and frogs according to season. (See Plate III.)

The best time to begin these lessons is early in March, provided that the cold of winter has sufficiently abated to make possible the procuring of a supply of frog spawn. Country children will be able to get their own spawn, but it must not be forgotten that many city children have never seen either a tadpole or a frog in its natural environment. The teacher who can supply each child with a few eggs in a jam jar will have no difficulty in keeping the interest alive for some weeks, especially if a separate stock of spawn is available for replacing casualties.

The teacher should be familiar with the following details in the life-history of the frog, even although the whole of the information will not be passed on to the children.

With the first warmth of spring, the frogs emerge from hibernation, which was passed in the mud of a pond bottom or in damp holes in the earth. The croaking, or love-song, of the male frog can then be heard, as can the answering croaks of his mate. The male climbs on to the back of the female

and remains in this position for days, eventually fertilizing the eggs as his mate lays them in the water. As the male is smaller and lighter than the female, this gives rise to the superstition that in the spring young frogs squeeze the old ones to death.

More than a thousand eggs are laid by the female, each egg being about the size of a pin-head and covered with a layer of jellylike material which in the course of a day or two swells out to about the size of a pea. During the ensuing ten days the embryo changes in form, becoming longer and finally showing a fish-like form.

At the end of a fortnight or more, according to temperature, the little tadpoles begin to emerge from the jelly. At this stage they have neither mouth nor eyes, but are able to fix themselves on to pieces of weed by means of a sticky patch beneath the head. Three or four days later the mouth appears, armed with rows of tiny teeth. The children will have to take the teacher's word for this, as the teeth are too small to be seen with the naked eye. The many rows of teeth act in the manner of a file, rasping off the surface of tender water plants. Little tufts appear on each side of the head; these are external gills by which oxygen is absorbed. These will later change into internal gills like those of a fish, the water being then taken in by the mouth and expelled through the gill slits.

At four or five weeks old the tadpole is about one inch long and spends most of its time feeding on green plant material, but is not above preying on some of his weaker brethren.

During the seventh week the hind limbs begin to appear, first as projections on each side of the body just above the tail. The fore limbs begin growth at the same time, but are not seen until later, as they are concealed by the gill covers.

All limbs are fully developed at the age of three or four months, and by this time lungs are developing, while the gills begin to be absorbed. At this stage the tadpole feeds very little and is less active, but comes to the surface frequently to breathe.

The tail now appears to be used as a food reserve, for as the tadpole continues to grow with little external nourishment the tail gradually disappears. Note that the tail does not drop off, as is sometimes stated, but is slowly absorbed.

By now the tadpole spends much time at the surface of the water, and in an aquarium provision should be made for this by having a large stone projecting from the water. Rafts of wood or cork are not very suitable, as the tadpole cannot easily climb on to them. A rock or other sloping surface up which he can climb is much better.

The creature, now about the size of a postage stamp, is no longer a tadpole but a frog, still showing the remnant of a tail. It is now ready to feed on insects and other small creatures, and as the supply of such food is almost impossible in an aquarium, the maturing frogs should be taken away to a neighbouring pond or stream.

The study of the full-grown frog will have to be continued by the aid of pictures, unless it is possible to obtain a frog from a nearby pond and return it after the lesson.

Although the frog is a lung breather, it is able to take in some air through its smooth, moist skin. This air is absorbed directly into the blood inde-

pendently of the lungs. Lung breathing in a frog is rather different from the breathing of higher animals. In the first place, the frog has no ribs and so cannot fill its lungs by inflating its chest. Breathing is a twofold process and can be studied by observation of a resting frog. First the nostrils open and the floor of the mouth is lowered, thus enlarging the space inside the mouth and drawing in air through the nostrils. Then the nostrils close and the floor of the mouth rises to force the mouthful of air into the lungs. The up-and-down motion of the underside of the mouth can be seen in a living frog. A frog cannot breathe with its mouth open, and would die of suffocation if the mouth were held open.

CROCODILE: NOTICE SCALES.

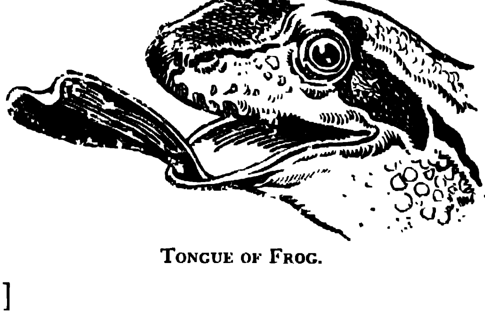
Note that both the nostrils and the large prominent eyes are so situated that the frog can remain almost submerged in water and yet breathe and see. A similar arrangement, with eyes and nostrils on the uppermost part of the head, is seen also in such semi-aquatic animals as the hippopotamus and the crocodile. The hind legs of the frog are considerably longer than the front ones, giving the creature an awkward waddling gait when moving slowly on land, but making possible the enormous leaps by which the frog can cover the ground when frightened.

Children can be told, but will rarely be able to see, the manner in which a frog catches flies for food. It has a long forked tongue attached to the floor of the mouth. When at rest the tip of the tongue is folded back towards the throat, but can be flicked quickly forward like the lash of a whip until it projects far beyond the mouth. During the flicking process the forked tip sweeps against the roof of the mouth and collects a sticky secretion which enables it to stick to the fly and return it to the mouth.

The whole process of flicking out and returning the tongue is so rapid that only careful and repeated observation will reveal what happens. Once the food is inside the mouth the eyeballs are used to assist in the swallowing. These are only separated from the mouth by a thin membrane and can be depressed into the mouth cavity. So that when a frog appears to be rolling his eyes he is actually using them to help to push food down his throat. The upper jaw alone carries teeth, small and curved slightly backward.

One question the teacher may have to answer is: Do little frogs sometimes come down in a shower of rain?

This question, not infrequently asked, appears to have arisen from a misconception, for in early summer, after heavy rains, myriads of tiny frogs may appear on the ground. Actually, these are frogs newly out of the tadpole stage, which have left the ponds



TONGUE OF FROG.

and streams of their birth and started on their wanderings. This they do only when the countryside is drenched with moisture, for a moist environment suits their bodies much better than a dry one. Although they may not readily hop out on to a dry road, a road running with water and full of puddles is no bar to their progress. It is probably the sight of many small frogs on paths and roads during a rainstorm that has given rise to the idea that they have come down with the rain.

Later in the year the phenomenon is not seen, the frogs having dispersed to various lurking-places in ditches, long grass, and hedge bottoms. Many of them do not long survive, for birds, fishes, and small land animals prey on them. Those which escape continue to grow, casting their skins from time to time, until after three or four years they are fully grown.

Children's Activities

(1) Keep tadpoles and watch their growth.

(2) Make a booklet about the life-history of a frog. For " cinema " booklets about the life-history of a frog see ENGLISH, Volume I.

(3) Draw pictures of tadpoles in their different stages.

COMMON BIRDS (see Plate IV)

Lessons on birds must perforce be given without the use of live specimens, but much can be done with suitable pictures and by suggesting observation tasks for the children. Stuffed birds may have some use for the examination of form and detail, but they are dull and uninteresting to children, to whom movement, habits, and activities of birds make the main appeal.

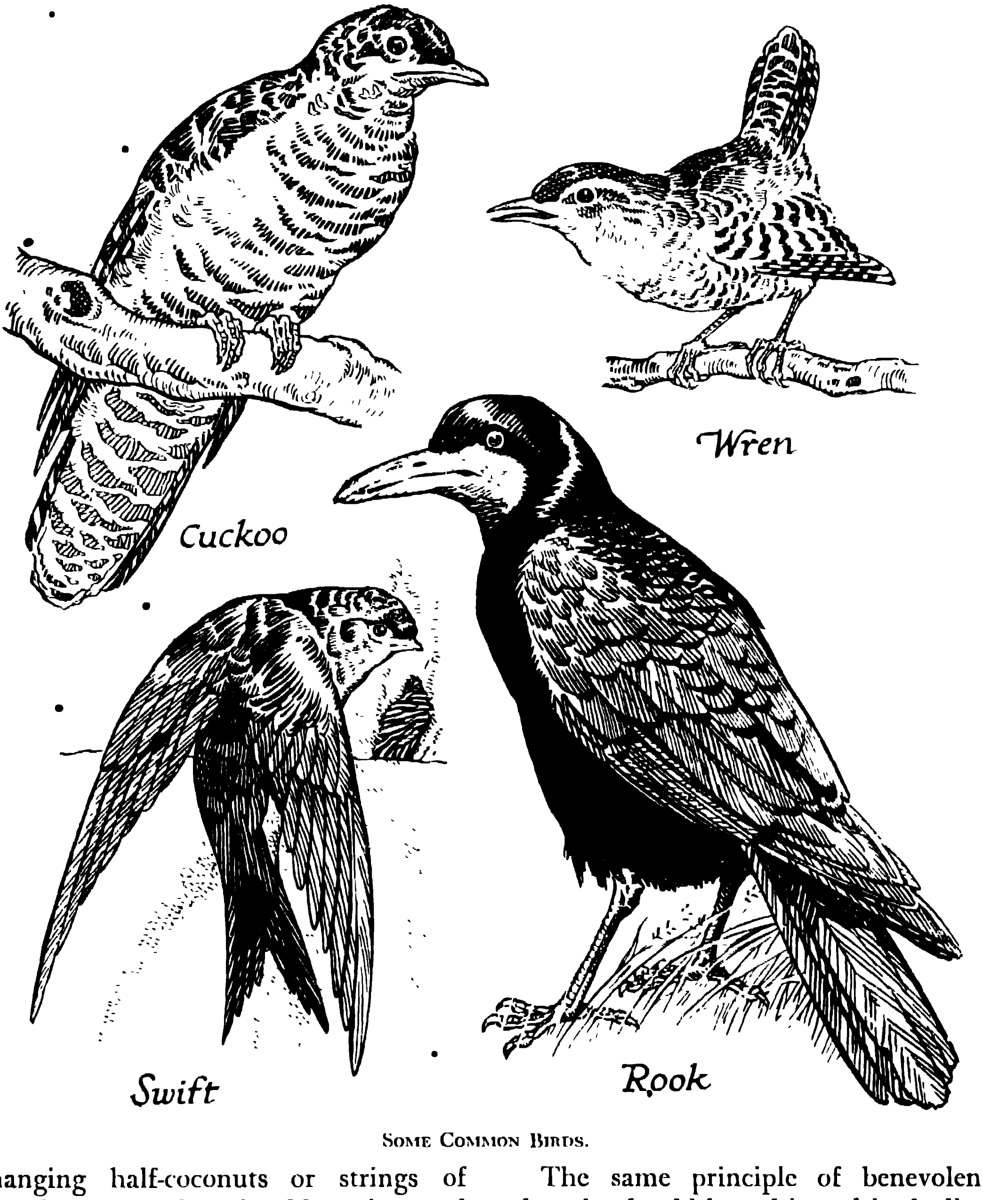
Whether in town or country, it will probably be convenient to confine observation to well-known and easily recognized types, such as the sparrow, starling, robin, blackbird, gull, thrush, pigeon, rook, swallow, tit, but children will also like to hear about the cuckoo, nightingale, and eagle.

Children should be encouraged to talk about the birds they know, naming them and observing their general habits and methods of feeding. As it is unlikely that during the lesson there will be any chance of watching birds, it will be necessary to talk about them with the help of pictures and to suggest things that the children might endeavour to find out for themselves by future observation. For example, some birds, like the sparrow, always hop with both legs at once, while others, for example, the starling, walk or run as children do.

Then there is the song of birds, some chirp, others sing. Children can be asked to learn to imitate the song of one or two of the better-known birds.

Some birds sing only in summer, but the starling sings all the year round, and the robin chiefly in winter. The overlapping of the feathers and the scale-covered legs may be discussed, also the way in which birds puff out their feathers to keep themselves warm in cold weather, but obviously the scientific principle involved here will not be pursued.

Methods of observing birds may be mentioned, but children of this age cannot be expected to cultivate habits of absolute stillness in the proximity of birds. They should, however, be encouraged to take a kindly interest in the welfare of our feathered friends by providing food in the form of crumbs,



SOME COMMON BIRDS.

hanging half-coconuts or strings of monkey nuts for the blue tits, and saucers of water for drinking and bathing. If these things are regularly placed within view of a window, either at home or at school, children will have an opportunity for observation and identification.

The same principle of benevolent thought should be cultivated in dealing with the subject of eggs and nests. At this stage the urge to make collections of eggs is not so strong as in later years, but this is the time to implant and foster the idea that the nest is the result of loving labour on the part of

the parents, that the eggs belong to them, and that it is unfair to deprive the mother-bird of her future babies.

Much good will be done if children can be induced to agree that a clutch of eggs looks best in its own nest, and that a discreet peep from time to time will provide more pleasure and interest than will the possession of a varied collection of eggs.

The following notes on bird types may be useful:

Sparrow: Brown back, grey breast, may look darker or even black in sooty towns. Beak and wings short, cock bird shows cleaner and more slender lines than hen and has a grey cap and dark, almost black, chest in spring. Sparrows haunt the same locality, nest untidy, built chiefly by cock, high up in trees or gutters, and roofed over. Eggs white. Birds sociable, generally seen in flocks, fond of taking dust-baths and water-baths. Food varied.

Starling: Brownish-black with black bill in winter, purple and green with yellow bill in spring, sociable, sings all the year round, makes untidy nest of straw, etc., in holes and crevices. Eggs long and pale blue.

Blackbird: Larger than starling, yellow bill, eats slugs, snails, berries, and fruit. Makes a nest in bushes, well lined with mud and grass. Eggs green with brown specks.

Thrush: closely related to blackbird, also to redwing and fieldfare, nest similar to blackbirds; eggs blue with brown spots, feeds on worms, snails, insects and fruit; breaks shells of snails by hammering on flat stone.

Blue Tit: Half-size of sparrow, light blue above, yellow below, tame, eats insects but fond of seeds and fruit, favourite visitor to bird-table; will hang upside down when pecking at inside of suspended half-coconut.

Swallow: Deep blue above, cream below, long wings and forked tail; flies open-mouthed to catch insects in flight. Nest, half-cup on wall below eaves. Arrives April, departs September.

House Martin: Like swallow, but tail shorter and less forked, white patch on back; nest built close up to eaves, with small entry hole at top.

Swift: Very dark brown but appears black, bigger than swallow, shorter tail; since all four toes face forwards, swift cannot perch but can only cling. Does not belong to same family as swallow and house martin. Arrives May, departs August.

Crows and Rooks: Both black and similar in appearance, but rook is rather smaller than crow and has bald patch on head. Also rooks live and hunt in flocks, but crows are more solitary and live in pairs. Both kinds build nests of sticks high up in trees and feed on insects, but crows also kill small birds and animals and eat carrion. Rooks use the same nests year after year.

Cuckoo: Grey bird nearly as big as a pigeon. Arrives April. Places egg in nest of hedge sparrow, meadow pipit, etc. Young cuckoo hatches out and ejects rightful nestlings and is then reared by its foster parents, who do not appear to notice the usurpation. Adults leave this country July or August, and young birds follow September or October.

Robin: Unsociable to other birds but tame in regard to man. Builds nest in odd corners and unlikely spots; adopts an area of ground as his own and drives away other birds. Sings in winter. Feeds on insects, worms, fruit, and seeds.

Children's Activities

(1) Make a bird alphabet book. (See English Section.)

(2) Make a booklet about your favourite bird.

(3) Make a list of birds *you have seen* in parks or gardens, etc. Write a few sentences about each.

II. Plant Life

Flowers and Trees

These studies will be largely concerned with the children's own observations, by inducing them to put their impressions into words, by enlarging their experience of Nature's wonders, exploiting their delight in form and colour and their interest in the manifold revelations of Nature.

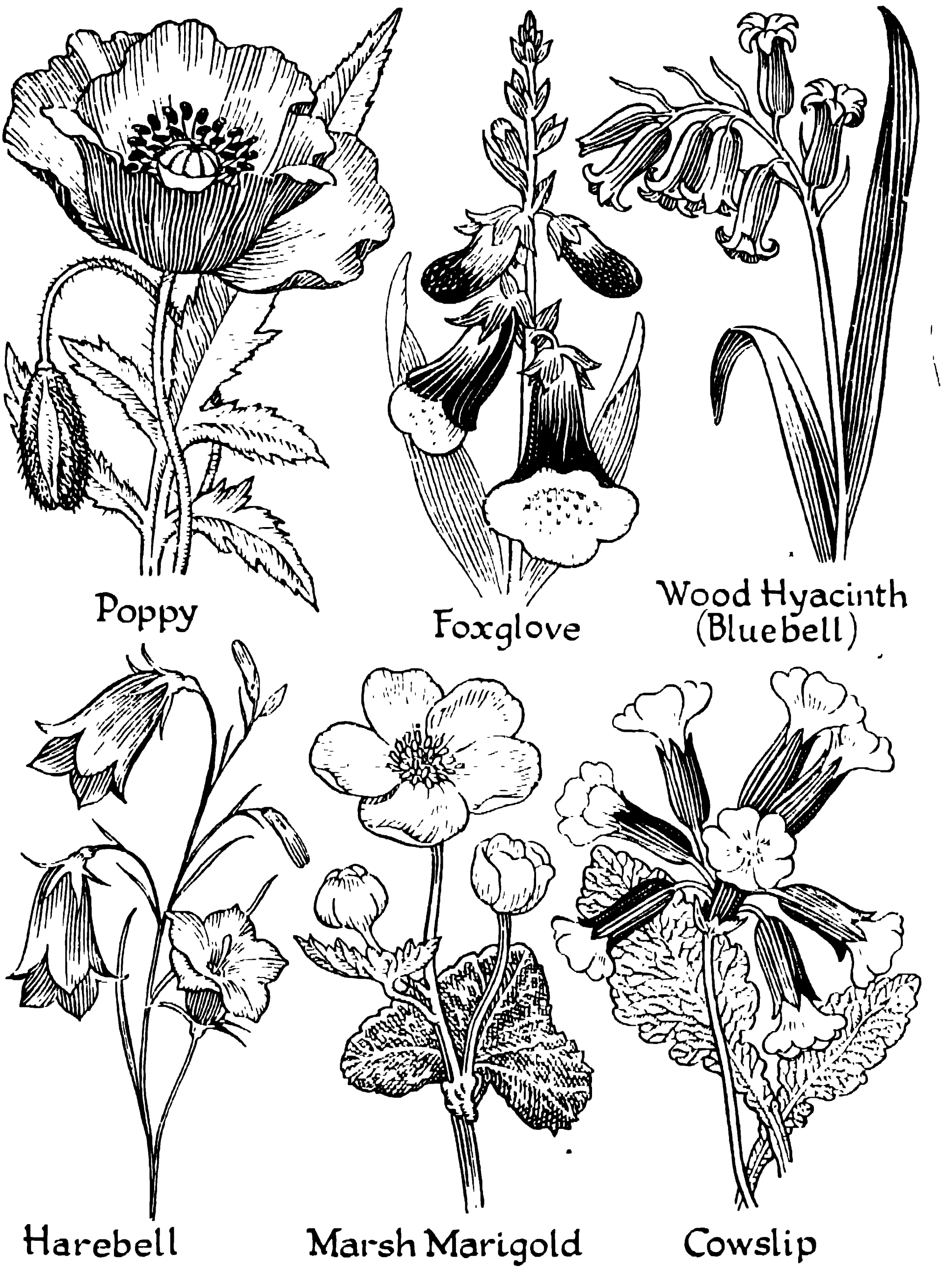
The subject-matter of each lesson will depend on the season and on the material available for them to handle. The more things they have to play with, the more satisfying will be the lesson, both to teacher and pupils.

The varied manifestations of Nature rather than their purpose will be the subject of study. It is sufficient to establish that spring is the time when germination and growth begin, summer the time of splendour, and autumn the time of fruiting. Any further spontaneous deductions should be treated sympathetically and as broadmindedly as possible. No attempt should be made to assert scientific principles or impose a logical sequence. Cut flowers might be displayed in the classroom when the season permits. Possibly one or two children may be ready to make themselves responsible for the supply. Snowdrops, crocuses, and daffodils in early spring will show that the winter is giving place to spring.

In towns and cities children may see these in florists' shops at a very early season, but they can be led to appreciate that these come from places with a warmer climate or from greenhouses where the air and soil are warm. Thus may be established the fact that warmth and sunshine play a part in producing flowers.

A test-tube rack holding a row of test-tubes or boiling tubes provides a convenient way of displaying clusters of small wild flowers. Lists may be made of flowers arranged according to season or according to colour.

Some children may succeed in drawing individual flowers, and most will enjoy using paint or crayon to bring out the colour. In doing this they will probably notice that, whatever the colour of the flower, there is usually some yellow in the centre. If this intrigues them, they may be told to hold a flower upside down over a piece of white paper and shake out the yellow pollen. Then can come a talk about bees as messengers of the flowers. The yellow pollen dust sticks to the legs of the bee as it enters the flower and with its long trunk sucks the nectar which is found deep down inside the flower. Children can confirm in their own minds the presence of nectar by detaching a petal of a buttercup and licking the inside at the base. The bee requires the nectar for honey-making. How does the bee pay for the nectar? It carries the pollen to the next flower it visits, and this pollen helps the flower to make seed for next year. Pollen from one flower is of no use to a flower of a different kind, but as the bee, in each journey from the hive, visits only one kind of flower, the pollen is distributed correctly.



Some Wild Flowers.

Butterflies, moths, and other insects also visit the flowers for nectar and so act as pollen carriers. Flowers such as the evening primrose, which open only after the bees have gone to bed, depend on night-flying moths and other insects as pollen carriers.

Where wild flowers are available in abundance, games with flowers will provide interest and give opportunity for self-expression. Some children will shine at making tasteful bouquets, others will want to make daisy chains, use a seeding dandelion as a clock, or a buttercup in the "Do you like butter?" game.

Stories about flowers, little poems and simple songs, may find their place in the lessons, provided that the connection is natural and not forced.

Collections of pressed flowers and leaves may be made, although the children will gain more from the *making of the collection* than from any subsequent reference to it. Leaves may be fixed with gummed paper directly in an exercise book, but flowers should first be placed between sheets of blotting-paper and pressed for a night under a pile of books.

Seeds may be sown in pots or shallow boxes, or in the case of mustard and cress, on damp flannel. Bulbs planted in autumn will give pleasure in spring before many wild flowers are available. Children may be put in charge of a pot or a box, but not many will keep up their enthusiasm during the long period of waiting, and most of the task of tending will devolve on the teacher, or if plants are grown at home, on the parent.

Where children are induced to take on little jobs of Nature Study at home the results are apt to be disappointing to the teacher, unless the parents take an intelligent interest in the child's activities. Many mothers will not be prepared to put up with the presence of pots of soil or jars of tadpoles in the house, and the child may soon become discouraged. Still, it is worth while to encourage home activities. There is always the chance that the education may be transmitted through the child to the parents.

Children's Activities

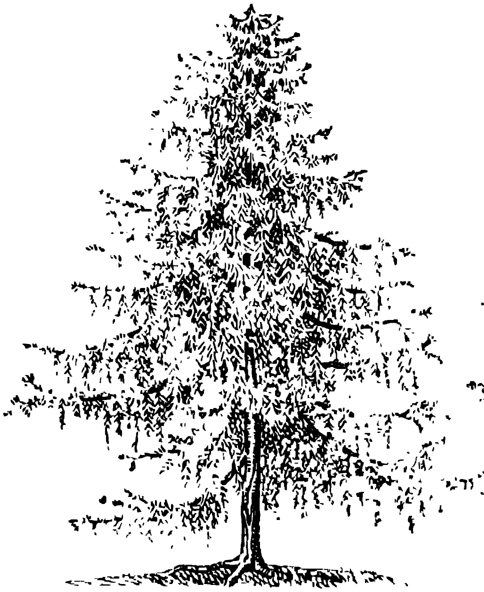
Make a flower alphabet book. For booklets about flower poems, etc., see Volume I, ENGLISH, Chapter XI, "The Response from the Children." Make a booklet about yellow flowers. Do the same for each colour.

TREES (see Plate V)

These can be studied in winter, and again in spring and summer. Reference may be made to the things we get from trees. A review of various articles made from wood makes a useful start. Doors, chairs, desks, and boxes will be mentioned, and probably firewood. Common woods may be named; for example, pine, ash, oak, birch, and beech, and a distinction made between hard woods and woods that are soft and easy to cut.

The great age to which trees live may be mentioned. For instance, the oak must live sixty or seventy years before producing acorns, and may survive for a thousand years or more.

The bark may be spoken of as the tree's overcoat. Since it is dead, it does not grow with the tree, and thick bark shows cracks as the tree grows. Thinner bark, such as birch, may stretch or, like the plane, fall off altogether, to be re-



Larch

Rowan or Mountain Ash

Willow

White Poplar

Some Common Trees.

placed by new bark. Cork is the bark of a type of oak tree that grows in Portugal and Spain.

The form and branching of the common British trees may be studied, also the shapes of leaves. Children will like to draw leaf shapes, and here pressed leaves or silhouettes (see page 151) will be useful. Collections of twigs will provide interest, and may in some cases, such as the horse-chestnut, ash, and beech, foster an interest in the recognition of leaf-buds and flower-buds.

The blossoms in spring can be named and admired as they become available, and in autumn games with conkers, acorns, ash-keys, beech-nuts, etc., will help to keep alive the interest in trees. The winged fruits of the sycamore, if dropped from a height or tossed into the air, are a never-ending source of delight.

The distinction between trees which are bare in winter and evergreens will be noted. The Christmas tree (spruce fir) will serve as an introduction to conifers. The larch, as the only non-evergreen British conifer, is easily recognized by children by the branches of needle-like leaves and the small, loosely built cones. Mention may be made of the hard elastic wood of the yew, which was much prized for the making of the longbow in the Middle Ages.

A distinction may be made between the horse-chestnut and the sweet or edible chestnut. Apart from some similarity in the appearance of the fruits, there is no relationship between the two trees.

According to the season, decorative effects in the classroom may be produced by arrangements of twigs, blossoms, leaves, or fruit, and will help both in the æsthetic and utilitarian education of the children.

Children's Activities

(1) Make a tree alphabet book. (See Volume I, ENGLISH.)

(2) Make a list of evergreen trees. Describe one you have seen.

(3) Draw a birch tree in summer and the same tree in winter.

(4) Draw a Christmas tree. Make a list of the things you would like to see on it.

(5) Describe your favourite tree.

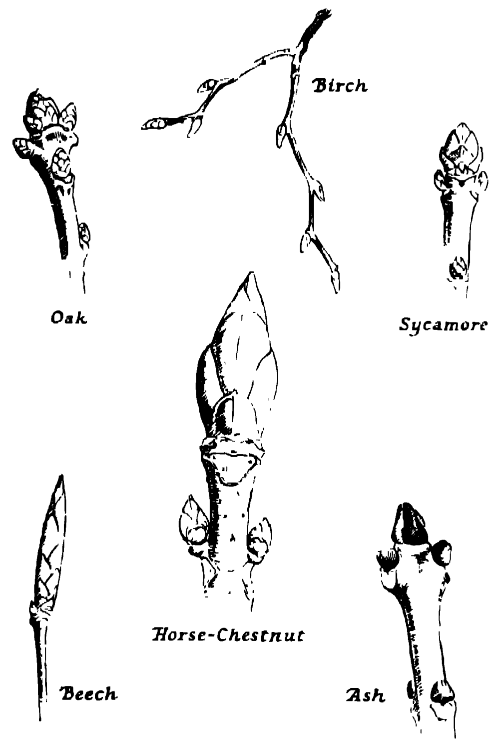
THE WINTER SLEEP

Late autumn is the time for these lessons. After the full-blooded activity of summer, Nature prepares to rest.

The tale of the Sleeping Beauty may be told or revived and parallels drawn in Nature. Perhaps the teacher may be doubtful about comparing the wicked fairy with cruel winter, but children are not fussy about these points. They will undoubtedly enjoy talks about the little buds, next year's twigs or leaves or flowers, sleeping soundly and protected from cold and rain. An examination of the horse-chestnut bud with its coat of varnish will illustrate this. Failing the bud of horse-chestnut, the tightly closed envelope of the brussels sprout may be shown.

Then there are the seeds containing a baby plant, the squirrel going to bed with his store of nuts, the hedgehog curled up in a hole under a hedge, the dormouse in his nest, and the frog buried in the mud.

Although many insects die when the cold season arrives, some go into hibernation. The tortoise-shell butterfly, for example, may be seen asleep in a corner near the ceiling. Most insects exist in



TREE-BUDS

winter in the egg or pupa stage, and eggs and cocoons can be shown to the children. They may be told that each cocoon contains a grub or caterpillar asleep for the winter, but ready when the time comes to wake up, no longer as a caterpillar but as a lovely butterfly or other active insect. At this stage the subject can be left and will probably be forgotten by the children, but at the right time they may be reminded of the sleeping palace of Nature and prepared for the more exciting developments following on the kiss of the spring sunshine.

Children's Activities

(1) Make a list of all the things that go to sleep in winter.

(2) Collect new words.

(3) Draw or paint bare trees and notice the pattern made by their branches.

THE SPRING AWAKENING

The bursting of the bud under the influence of the warmth of spring, the first appearance of green shoots from seeds left in the ground, and the gradual clothing of the trees in green can all be noted and reported by observant children. There will now be plenty to see and talk about, and lessons will probably be largely a matter of comparing notes and relating experiences.

Even in cities there will be plenty of material, especially in the public parks. The appearance of moths and butterflies will be a source of pleasure (Plates XI and XII), and here it will be sufficient if they learn to distinguish a moth from a butterfly without going into anatomical distinctions. In this country most moths when at rest have their wings open, while butterflies on alighting keep their wings erect and back to back. Seeds sown in boxes or mustard and cress on damp flannel or blotting-paper will be observed to sprout. In the country animal activity may be reported.

The arrival of birds not seen in winter and their nest-building activities can be commented on. When the cuckoo is first heard, a lesson on this bird and its habits would not be out of place.

To many children of seven may come the first realization that spring is a time of joy and bustle in Nature, and it is now that the foundation of a real love of Nature may be laid. There is no lack of subjects for Nature lessons in spring.

Children's Activities

(1) Write down the names of all the birds you saw yesterday.

(2) How can you tell the difference between a moth and a butterfly?

(3) Have you seen any trees with the buds opening? Give the names of the trees.

(4) Have you seen any living creatures that have awakened from their winter sleep? What are they?

III. Related Science

These lessons will of necessity encroach on the Geography syllabus, and some teachers will prefer to give them under that heading. They deal, however, with subjects that are just as much manifestations of Nature as are the lives of plants and animals, and if the lessons overlap no harm is done. The order may be dictated by convenience, but THE SUN is a good starting-point.

What do we notice on a sunny day? We have warmth, light, shadows, dazzle. Animals bask in the sunshine or seek the shade of walls and trees.

Ask children to point to where they think the sun rises, where it sets, where it is at noon. (The modification due to Summer Time may have to be dealt with.)

POINTS OF COMPASS

With the children in a ring in hall or playground, first establish the position of the south. Mark the four cardinal points on the floor. Ask questions, who is in the north? Who is in the east? etc. Which windows in the school face south? Which room gets most sunlight? Which rooms are sunny in the morning? in the afternoon? Which streets run north and south? east and west?

If the classroom runs square north and south, the letters N, S, E, W may be painted or hung on the appropriate walls. In other cases a large crossed arrow may be painted on the ceiling and the cardinal points marked on it.

Maps or plans of classroom or playground may be drawn, and an arrow shown pointing north. (See GEOGRAPHY. Volume III, Chapters II and III.)

ALTITUDE OF SUN

How high is the sun in the morning, at noon, in the evening? No difficulty will be found in establishing that the sun is high in the sky at noon and low morning and evening, or that the sun rises in the east and sets in the west. The meaning of dawn and dusk and twilight may be given. The fact that the sun is higher in summer than in winter may not be realized so readily, as reference to earlier experience is necessary for this. Some child may remember that in a certain room the sun was low enough in winter to shine in his eyes, and may notice that in summer, sitting in the same place, he is not dazzled. (See GEOGRAPHY, Chapter IV.)

THE SHADOW thrown by a fixed post in the playground may be measured at different times of the day and at different seasons at the same times of day, and the inference drawn.

The various effects caused by the sun having been dealt with, something may be said about the sun as an object. It may be viewed through smoked glass or on a foggy day, to establish that it is a round object.

How big is it? First establish that big things look small at a distance; for example, a bird, aeroplane, or man. Astronomical sizes and distances are beyond a child's comprehension. No child, and few adults, can have a precise idea of a million, except that it is a very big number. A vague idea is given if we

think that it would take about three days to count to a million.

Nevertheless, there is no harm in talking about the size and distance of the sun and thus enhancing the child's wonder at the vastness of Nature. If the sun could be broken up into a million pieces, each piece would be larger than the earth. The distance of the sun, more than 92,000,000 miles, can be portrayed by suggesting that if an aeroplane could travel from here to the sun, the pilot, starting as a young man, would be an old man on arrival.

The sun is very, very hot, hotter than anything on the earth. If it were very near to the earth we should all be roasted alive. The sun is a star, just like the many tiny stars that twinkle in the sky. Some of these are bigger than the sun, but are so far off that they look smaller.

The romance of the early ideas about the sun and the mythical tales relating to it should be made much of. The worship of the sun as a god by people to whom it was an object of awe and wonderment; the bewilderment of early civilizations at the constant journey of the sun from east to west; and the conjectures as to how, after setting in the west, it got back to the east in time to rise next morning, are all useful themes capable of enlargement according to the teacher's fancy. "Vulcan and his golden goblet" is a suitable mythical tale to tell, or "Ra, the Sun God of Egypt." (See Volume II, HISTORY.)

It is better not to attempt any explanations as to how our present knowledge of the sun was arrived at. Copernicus and Galileo should be left for later lessons.

There should be no difficulty in establishing the fact that we now know that the sun only *appears* to move because the earth is spinning round on its axis. Children will appreciate this if reminded of the times they have sat in a slowly-moving train and thought an adjacent train was moving. Thus the idea of day here, night on the other side of the world can be developed.

SUNBEAMS

A study of sunbeams or beams of artificial light may be used to bring out simple facts about light, such as that light travels in straight lines, that some objects are transparent and others opaque, also that opaque objects cast shadows.

On a sunny day a room with drawn blinds or curtains, with a beam of sunlight coming through a hole or chink, will serve for a demonstration. Generally, there will be enough dust to show the path of the beam, but if not, a board duster shaken in its path will reveal its presence. The children will then see that it shines in straight lines, makes a bright spot on the floor, will shine through a piece of glass but not through a book or a child. (Why does Father say, "Please do not stand in my light"?)

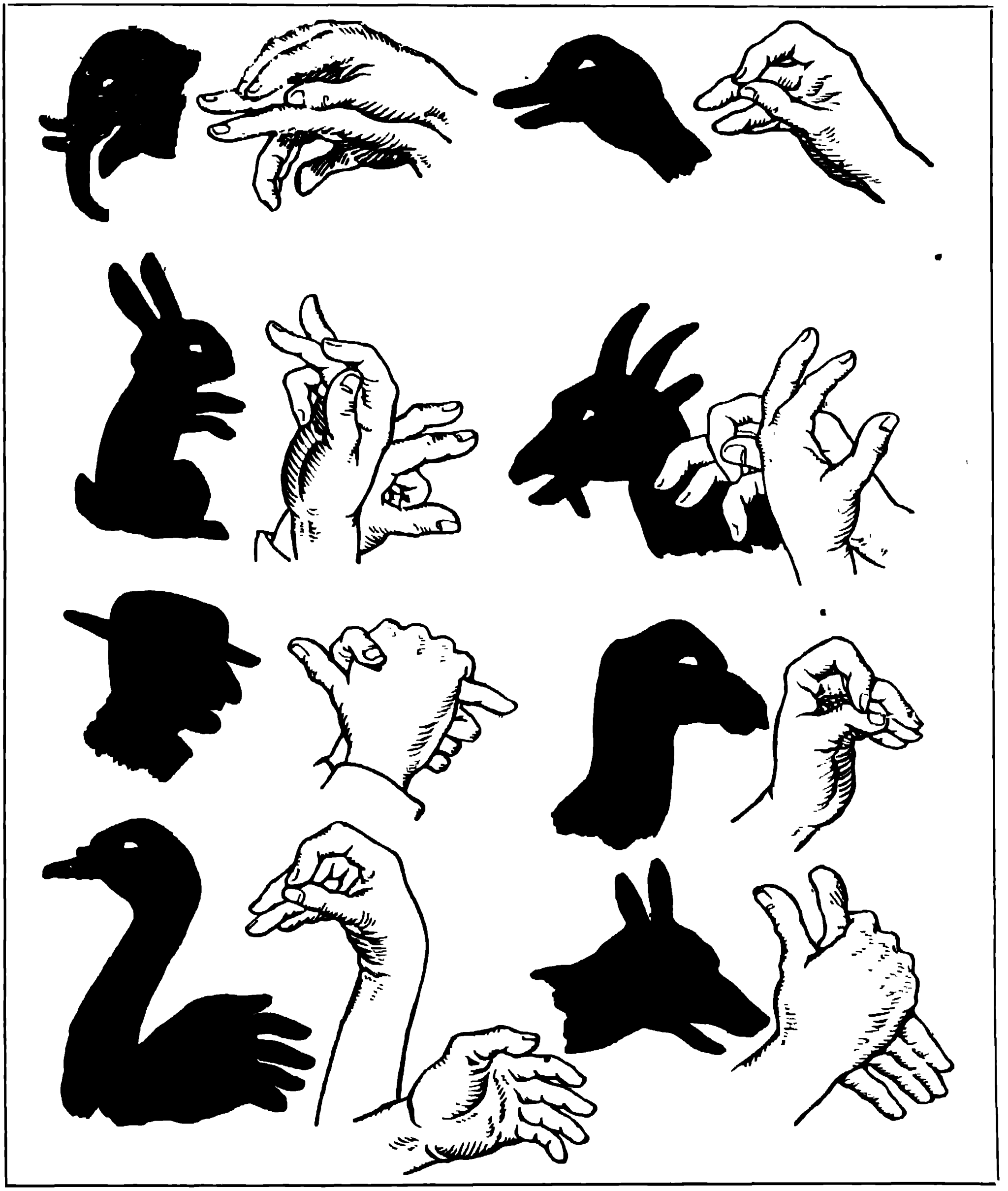
Failing the sunbeams, an acetylene lamp, electric torch, or optical lantern in a darkened room will provide the necessary light. A white sheet of paper may be used as a screen and children allowed to make hand-shadows to represent swans, ducks, rabbits, etc. Also the shadow of a child's head thrown on the screen may be outlined in pencil and afterwards cut out and blacked to make a silhouette.

RAIN AND CLOUDS (Plate VI) provide ample material for simple lessons. The kinds of clouds may be observed, but no

THE PATH OF A BEAM OF LIGHT.

attempt made to give them their scientific names. Comparisons can be made with wisps of white smoke or steam, masses of cotton-wool, and so on. It may be noted that the high white clouds do not as a rule presage immediate rain, but that the low black clouds generally result in showers.

Perhaps with the teacher's help the children may be able to make up a



PICTURES MADE FROM HAND-SHADOWS.

story about a raindrop; for example, starting from the middle of a big black cloud, getting bigger and bigger as it descends, falling with a splash on the dusty pavement, joining with other drops to make tiny rivulets running towards the gutter and washing the pavement clean. Or falling on dry fields, sinking into the parched ground, giving life to the drooping plants, and bringing joy to the heart of the farmer or gardener.

General questions about the uses of rain may be asked. Answers such as washing the streets, filling the streams, helping the plants, and providing water for us to drink will probably be made. The making of mud from dust and the drying of mud to make hard ground may also be touched on.

The slanting descent of raindrops in a wind, and even the general direction of the rain-bringing winds may be noted. Mention of umbrellas and waterproofs leads to a discussion on porous and non-porous substances.

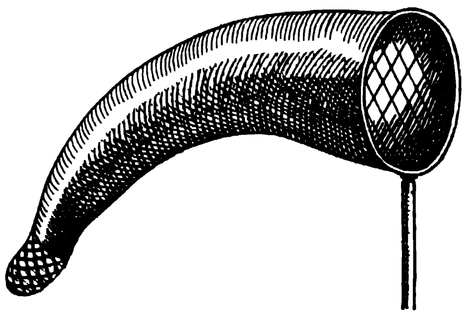
Rainbows will be mentioned, but only their shape and colour studied. The relation of rainbows to rain can be brought out. No rainbow without rain, although the observer is not necessarily in the rainy place. Where is the sun when you see a rainbow? Answer: somewhere behind you.

For weather diaries and weather charts, etc., see Volume III, Geography.

Wind

A talk about weathercocks not only serves to introduce the subject of wind, but also to crystallize ideas on the points of the compass. It is well to remember that many weathercocks, being inaccessible to anyone but a steeplejack, may eventually suffer from lack of lubricant, and so may be misleading as to wind direction. Another point of confusion is that ground winds are not always the same as winds at weathercock level.

Home-made model weathercocks are apt to be disappointing, except in a strong wind. It is not easy to make a weathercock which turns freely on its pivot. The head, or pointing part, must offer a smaller surface area to the wind than the tail, but both halves should be



A Drogue or Windsleeve.

of the same weight in order to balance each other and so reduce friction at the fulcrum. This calls for considerable ingenuity in design.

A drogue or windsleeve such as is used on airfields is easier to make, but needs a fairly strong wind to raise it. A light ribbon at the top of a high pole is probably the simplest wind-vane to make, and is likely to be the most satisfactory.

If these points are borne in mind, there is no reason why children should not be allowed to try their hands at making wind-vanes from cotton-reels and cardboard. Paper windmills will, however, be more easily made, and will give more pleasure. These may suggest a talk about windmills in general. Children should understand that an east wind blows *from* the east and not *to* the east.

Such terms as breeze, gale, hurricane may be introduced. The effects of wind on various things can be spoken of—the slamming of doors, rattling of windows, the effects on hats, umbrellas, tiles, dust, the making of waves, uprooting of trees, and so on. Then there are the uses of wind—helping the sailing-ships, turning windmills (now chiefly used for pumping water), changing the air, bringing in the fresh-

WINDMILL.

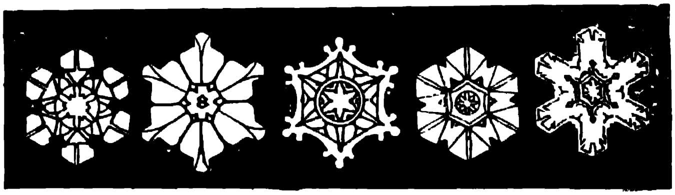
ness from the sea, and blowing away the clouds.

FROST

Jack Frost is always popular with young children, because he brings new experiences and changes the whole face of Nature. The lessons are best taken when frost or snow is in evidence.

A piece of ice should be placed in a glass of water to show that it floats and to let the children see that the part

under water is much bigger than the part above. Then would come a talk about icebergs and the danger to shipping. The story of the loss of the *Titanic* might here be told. A reference to the ice on a pond, floating on the top and leaving room for the fishes to swim about underneath, should be made. A note of the smoothness of ice would lead to talks about sliding and skating (curling in Scotland).



SNOW CRYSTALS.

Icicles may be examined. How are they formed? Does running water freeze as easily as still water?

Snow should be treated objectively and no attempt made to define its origin. Pictures of snow crystals may be shown, but the teacher should beware of the statement in some books on popular science that a few snowflakes caught on the coat sleeve and viewed under a magnifying-glass will look like these crystals. In this country snow crystals are not often seen, as they melt and lose their shape too easily. In the cold, dry air of alpine regions they may be seen if caught on a surface that is below freezing-point.

Hoar frost may be spoken of as frozen dew, but rime, which is the result of the sudden chilling of the water vapour of the atmosphere, is best left unremarked, as the idea of water vapour freezing is likely to be unintelligible to children at this stage. In the same way, the children will have difficulty in appreciating that the blanket of snow on the ground keeps the plants from dying of cold, and if this fact is mentioned it need not be stressed. A snowball may be squeezed in the hands, and the fact that it becomes hard and that ice may be formed by squeezing snow may be noted.

Ice, frost, and snow provide good subjects for description, and much can be said about the beauty of frost-clad trees and a snow-covered countryside. This, with discussions of the children's own reactions to these new experiences, will form the main theme of the lessons.

Children's Activities

(1) Making booklets about (*a*) the Wind, with a picture of a windy day, etc., on the cover. (*b*) The Rain. (*c*) Snow and Ice. Children can copy pictures of snow crystals and notice they are six-pointed stars.

(2) Draw a picture of a snow-man. Draw another of the same snow-man when the sun comes out. Drawing and painting winter scenes.

HOAR FROST.

(3) Drawing rainbows with coloured crayons, or drawing and painting them. Drawing and painting cloud pictures. (See Plate VI.)

(4) Children like to make a booklet about the sun in which they write down all they have found out or learnt about the sun.

(5) They read stories about the sun's journey across the sky, stories of the clouds, etc., in *A Tale in Everything* (London University Press).

CHAPTER THREE

MATERIALS, SUGGESTIONS, AND ACTIVITIES FOR SECOND YEAR'S WORK

THE order of the syllabus will be dictated to a certain extent by the seasons and by the availability of material, but some attempt may be made to establish a logical sequence of subjects.

It is immaterial whether the section on animal life comes before or after the one on plant life, but whichever section is chosen should be completed as far as possible before passing on to the next.

The astronomical part of the related Science Section is suitable for the dark days of winter, and if necessary could be separated from the remaining part. Foggy and misty weather would probably suggest to the teacher the advisability of breaking into the syllabus with a lesson on fogs and mists. The experiments with sand and clay are a preliminary to the future study of soil, and as soil, warmth, and moisture all have a bearing on plant life, this section could with advantage be dealt with before the study of plants begins.

A simple presentation of all subjects will still be necessary, and inculcation of scientific principles should not be attempted. The main aim will be to encourage the use of observant faculties in the children, add to their experience, and increase their knowledge of the facts of Nature. Except where necessary to satisfy their curiosity, children of this age should not be troubled with causes and reasons.

I. Bird Life

Birds and their Young

Required: Nests and eggs from school museum; pictures of young birds in nest, of hen and chickens, etc.

Where do baby birds come from? A comparison may be made here with the seed which gives birth to the young plant. The seed gives protection to and contains food for the baby plant. Similarly the baby bird is protected by the eggshell, which also contains food to nourish it until it is strong enough to come out of the shell.

How do the parent birds make provision for their babies? A whole lesson, or indeed several lessons, may be devoted to a consideration of nests and nest-building. A general distinction may be made between nests built on the ground and nests built in trees, hedges, and other places difficult of access.

Then the fact should be brought out that some birds are born naked and helpless and others with a coat of down; the latter are able to run about at once. A consideration of many types will show that the naked, helpless birds are

NEST STAYING BIRDS NEED TO BE FED BY PARENTS.

as a rule born in well-made, cosy nests, out of reach of danger, whilst the down-covered, active baby birds hatch out in roughly-built nests on or near the ground, or even on the bare ground.

Children will readily jump to the obvious conclusion that the naked bird needs the protection of a comfortable, safely sited nest until it is big enough to look after itself.

They should be asked why the nest for the fully-formed baby is built on the ground. Why not in a tree? Call attention to the small, stumpy wings on one of these young birds, say—a chicken. Would it be safe in a tree if it left the nest? The young bird may be able to run about on the ground, but is not yet able to fly. The teacher should be ready to discuss other differences between nest-staying or nidicolous young birds and nest-leaving or nidifugous young. The degree of difference may vary with the species, but in general we can say that nidicolous birds are born naked, or nearly so, in well-made, well-protected nests lined with down or other soft material to protect their tender skins and keep them warm. They are blind and helpless, unable to seek their own food or even to pick up morsels that are not dropped directly into their beaks. They may not be strong enough to leave the nest for many days, and during these days require the protecting warmth of the mother's (or father's) body.

On the other hand, the nidifugous birds have developed more fully before being hatched and are able to run about within a short time of leaving the egg. Beaks and claws are more fully developed, and the birds are able to leave the nest, in most cases never to return.

The nest is just a place for the eggs to hatch and is not required as a nursery. The birds may still require parental care and guidance, however, and in such cases will follow one or both parents, responding to their calls when food is found, or to their warnings at the approach of danger.

Some nidicolous or nest-staying birds are: sparrow, thrush, blackbird, robin, rook, crow, swallow, swift, hedge sparrow, cuckoo, owl, tits, and finches.

Some nidifugous or nest-leaving birds are: domestic poultry and ducks, pheasant, partridge, lapwing or peewit, snipe, heron, moorhen.

NIDIFUGOUS OR NEST-LEAVING BIRD

Parental Care

Start with nest-building; the building of a house for us to live in requires the help of many different craftsmen: bricklayers, carpenters and joiners, tilers, plumbers, glaziers and painters, also the use of many kinds of tools. The parent birds build a nest for their babies without outside help and with no tools other than beak, claws, and breast. All materials—sticks, dried grass, mud, etc. —must be carried to the site in small quantities. How do the parent birds learn the complicated business of nest-building? Perhaps a year ago they were only baby birds themselves. Here is cause for wonder and admiration.

Siting of Nests

(1) At the top of tall trees: rook, crow, magpie, heron.

(2) In bushes and hedges: thrush, linnet, finch, some tits, hedge sparrow.

(3) In burrows or holes in banks: kingfisher, sand martin.

(4) On or in houses or other buildings: sparrow, starling, swift, swallow, house martin, robin, barn owl.

(5) On the ground: peewit, partridge, pheasant.

(6) Over or near water: moorhen, reed warbler.

(7) Among high rocks or mountains: eagle, buzzard, curlew.

(8) Holes in trees: woodpecker, tits, nuthatch, tree creeper, some owls. These are typical situations, but cannot be taken as definite; many birds show variations in nesting habits and some build in unusual situations. Children will be interested in, and may also contribute, accounts of nests built in strange places, as, for example, a robin's nest in a discarded plant pot, or the nest of a tit in a country letter-box.

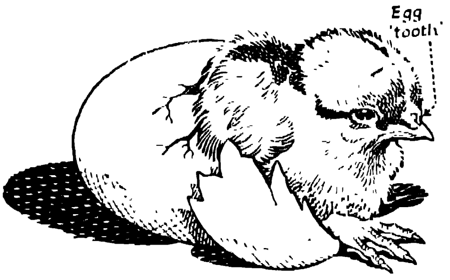
Kinds of Nests

These can best be illustrated by the exhibition of deserted nests, of which a collection might be made and kept. The loosely-built, untidy nest of the sparrow is hardly worth exhibiting, but the thrush's nest, closely woven and lined inside with hard, pressed mud, or the similar but less compact nest of the hedge sparrow, are object lessons in ingenuity and adaptation. The swallows build their nests almost entirely of mud, and so each section must be allowed to set before another is added. Rooks and pigeons are satisfied with nests of crossed twigs or sticks. Nests on the open ground are often little more than hollows in the earth or grass, perhaps lined with a little dried grass and not easy to pick out among their surroundings; examples, lark and peewit.

Eggs

If these are available, they can be examined and named. Attention may be directed to the colour—white, self-coloured, or mottled. In general, white eggs are laid in covered nests or in holes in banks, etc. Eggs in open nests, especially those on the ground, usually tone with their surroundings. A peewit's nest, for example, even with the eggs in it, is indistinguishable from the surrounding ground, except at close quarters.

Something may be said here about the dangers to which eggs are exposed from marauding animals. We like to eat eggs, and so do many other animals. Weasels, rats, badgers, and sometimes squirrels, all take their toll, so well concealed or camouflaged eggs have more chance of surviving.



CHICK HATCHING.

Hatching

Small birds hatch out in about a fortnight, larger birds, such as the rook, hen, or pheasant, in about three weeks.

Warmth is needed for incubation, and is provided by the mother's body. She may sit continuously on the nest, being fed by the male, or the male may do his part by relieving the mother while she goes off in search of food. The little chick, by the time it is ready to hatch out, has developed an "egg tooth," or horny, pointed excrescence on the top of its beak. With this it scratches and chips at the shell until it is able to break a way out. Soon after hatching, the egg tooth drops off.

Shape of Eggs

Notice the different shapes: (1) almost round, such as those of owl and kingfisher; (2) oval, such as the eggs of domestic poultry, partridge, pheasant, etc.; (3) pointed ends, as for example the peewit.

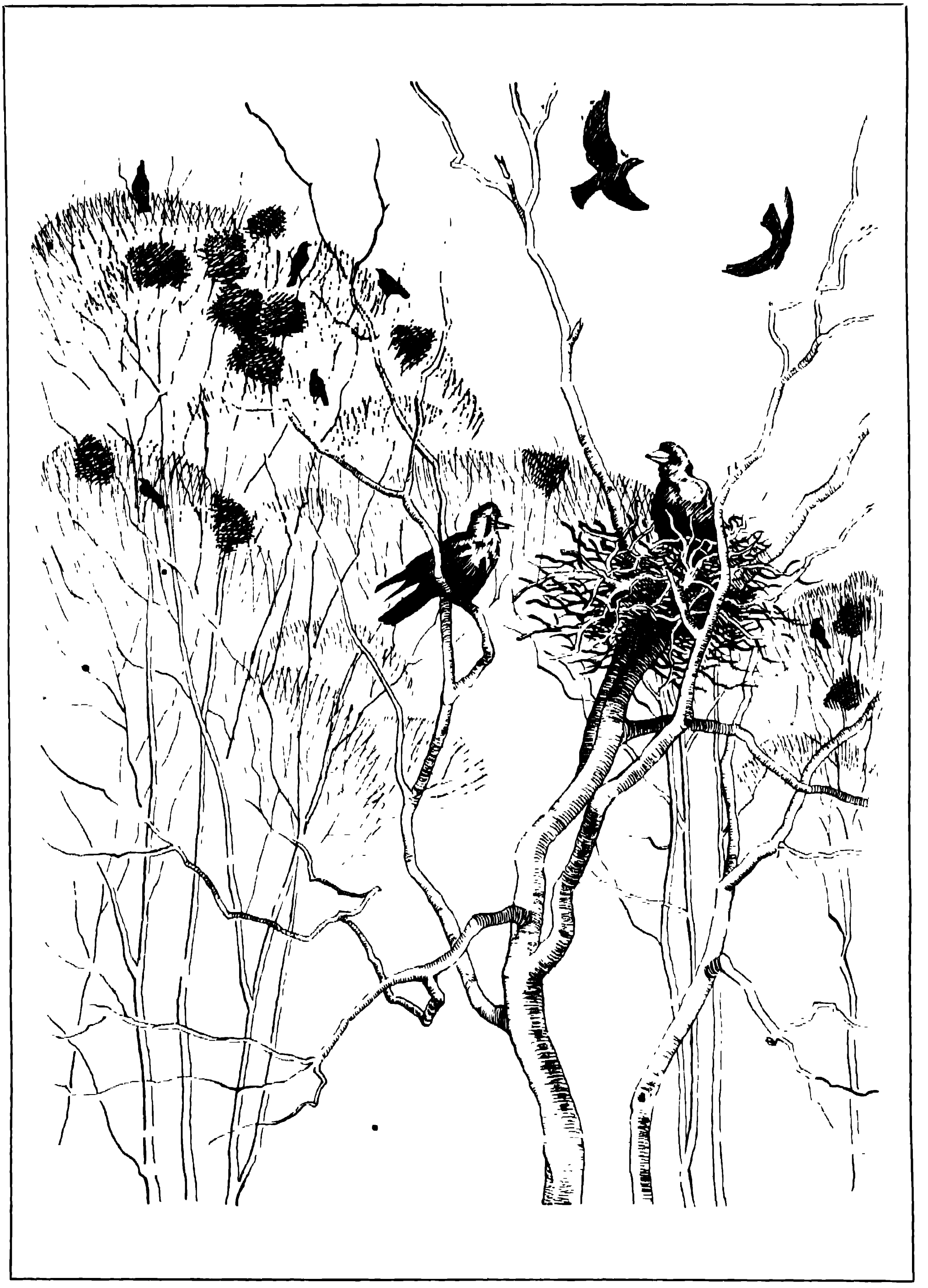
Show how a clutch of oval or pointed-end eggs are arranged in a nest with the more pointed ends to the centre, thus giving a closer pack. Also show what happens when a pointed-end egg rolls. Some seabirds, as for example the guillemot, lay their eggs on rocky shelves without troubling to make a nest. These eggs have pointed ends. Why do they not roll off the cliff?

Enemies of Birds

Cat, birds of prey, rat, stoat and weasel, man. Grown-up birds can escape from their enemies by flying away. Young birds are in more danger until they have learnt to fly. They require protection, and this is given in several ways. (1) By concealment or inaccessibility of the nest. (2) By active protection by the parents. Even small adult birds may fight to protect their young and by swooping fiercely at the head of the marauder may drive off even such a large animal as a cat. (3) By community protection. Rooks, herons, gulls, etc., nesting in rookeries, combine to drive off assailants. (4) By protective coloration. Pheasant, partridge, grouse, peewit, etc., are not easily distinguished when on the ground. (5) By ruses on the part of the parents. The peewit, on the approach of danger, utters a warning cry to her young, who at once crouch and remain perfectly still, while the mother flies in erratic swoops, with shrill cries, trying to attract the attention of the enemy and so cause him to miss the young birds. The partridge has been known to simulate lameness or a broken wing, struggling over the ground in front of a walker, until he has been led safely away from her young.

Feeding of Young Birds

It is better to make no attempt here to specify the various kinds of food eaten by different birds. This study is better left until the lesson on beaks of birds. All that is necessary to bring out at this stage is the fact that the helpless nidicolous young are regularly



A ROOKERY.

fed by the parents and that this necessitates strenuous work and very many journeys in search of worms, insects, etc. In the early stages the young birds are unable to use their beaks, and so the parent pushes the food well down into the chick's throat.

Even when the young have left the nest, the parents continue to feed them until they are able to find food for themselves. The young thrush, for example, follows its mother about lawn or field and receives from her beak the worms she finds. This feeding may go on until the young bird is as big as its parent.

All the bird studies so far will serve to emphasize the devotion and self-sacrifice of the parents, in preparing the nest, hatching the eggs, protecting the young, and providing them with food

Children's Activities

(1) Try to make a nest with dried grass and mud. Compare it with the nest of a thrush or blackbird.

(2) Make a list of birds born naked and helpless, and another of birds able to run about soon after birth.

(3) Write down the names of as many birds as you can think of. After each name say where the bird usually builds its nest, i.e. on the ground, in trees, in bushes, etc.

(4) Make lists of birds which build (*a*) cup-shaped nests, (*b*) nests with covered tops, (*c*) nests lined with mud, (*d*) nests of sticks, (*e*) nests in holes in trees, (*f*) nests in holes in the ground.

(5) Make up a tale of a peewit and her young. Imagine that a cat is creeping towards the nest. Say what the mother does and what the babies do.

(6) Make a little booklet about baby birds.

The Beaks of Birds (see Plate VII)

This subject makes an interesting and instructive study and is linked with the feeding habits and general mode of life of the birds. Birds living on grain, seeds, or nuts have in general short, strong beaks with which the outer shell can be crushed. Good examples are the sparrow and all finches. As the canary is a kind of finch, a canary in a cage makes a good illustration. The hawfinch is less likely to be seen, but the picture on Plate VII shows clearly the large nutcracker type of beak. Pigeons and all kinds of tits are other examples.

Thrushes, blackbirds, starlings, and peewits have long beaks like forceps, useful in digging for worms or in extracting a snail from its shell; a thrush frequently takes a large snail shell in his beak and hammers it on a stone until the shell breaks.

The woodpecker has a similar but stronger type of beak capable of pecking a hole in the bark of a tree. The long spear-like beak of the heron is a powerful weapon capable of killing large fishes, frogs, etc.

Swallows, martins, and swifts have thin, small beaks capable of opening wide, for they fly with open beaks and catch insects on the wing; note that in dull weather the swallows fly low, as gnats and midges are then near the ground, but on bright days the insects fly higher and the swallows do likewise in search of their prey. Birds of prey and most flesh-eaters have strong hooked beaks; note the beak of the golden eagle, or of the sparrow hawk.

The hooked beak of the parrot is interesting. Most birds, like human beings, can move only the lower jaw (let children try to open their mouths without moving their chins), but the

parrot family have double-jointed beaks and can move either the upper or lower jaw. The parrot's beak is useful for cracking nuts, his natural food in the wild state, or for assistance in climbing.

Ducks, geese, and swans have flat, shovel-like beaks. A duck shovels up liquid mud from the bottom of a pond, then squeezes out the muddy water with her thick, muscular tongue. Thin strips of horn along the edges of the beak act as a strainer and prevent the expulsion of food. The duck's beak is slightly hooked at the tip and higher up is covered with a soft, sensitive skin which enables her to feel what is in the mud. The edges of the beak and the tip are sharp enough to cut the stems of weeds or kill snails by severing them in two.

Something may be said about birds and their food in relation to agriculture. The majority of birds are regarded as useful to the farmer, and in these days there is less destruction of birds on the plea of farm economy than once was the case. The subject is, however, still a controversial one, and the farmer's view does not always tally with that of the non-agricultural bird-lover.

Birds whose food is almost wholly grain are regarded as harmful; such are the pigeon, most finches, and the house sparrow. The starling, thrush, and blackbird may do much damage to fruit, but otherwise are useful in keeping down the numbers of harmful insects. Rooks are said to eat much grain, but there is no doubt that they also do much good by eating wireworm, leatherjackets, and many other insect pests.

Insect-eating birds are classed as beneficial, as they destroy many insects in the larval or grub stage which would

Woodpecker's Nest.

otherwise do much harm to crops. Birds of prey, including owls, help to keep down the numbers of rats and mice. Even the cuckoo is classed as useful because it eats hairy caterpillars, which are avoided by other birds.

Feet of Birds (Plate VII)

These make an interesting study, which, like the study of beaks, serves as a basis for a consideration of the mode of life of each kind of bird.

Note that most birds have four toes, generally three in front and one behind, although some climbing birds have two in front and two behind. Feet may be classified as follows:

(1) *Grasping*—birds of prey; strong claws with a wide spread and strong, hooked claws.

(2) *Scratching*—fowl, pheasant; long toes with stout, short claws to scratch

the ground and uncover insects and seeds.

(3) *Perching*—thrush, lark, and most of the smaller birds are classed as perching; long toes, three in front and one behind (opposed). A perching bird alights with straight legs, grasps the perch or branch and then bends the legs as though squatting or sitting down. The squatting action brings into play strong leg muscles which close the toes firmly round the perch. The lower the body sinks the more firmly do the toes clamp round the perch. Thus there is no danger of the bird falling off even when asleep. To leave the perch the bird must first stand up to loosen the toe grip. Most birds can perch, although some of the birds not classed as true perchers have toes adapted for other purposes as well. Birds such as the swift, with all toes pointing the same way, i.e. with no opposed toes, cannot perch, but can only cling.

(4) *Climbing* — woodpecker, tree-creeper, wryneck (cuckoo's mate); the forward-pointing toes have sharp hooked claws. The woodpecker and the tree-creeper brace the tail against the tree trunk in climbing and thus ease the pressure on the backward-pointing toes.

(5) *Wading*—heron, stork; long legs with wide-spreading toes.

(6) *Swimming*—duck, goose, swan, gull; web-footed, the three forward toes joined by tough, flexible skin. The swimming action is rather like walking. As the foot goes forward the toes close up, then open out for the backward thrust to offer full resistance to the water. The legs of swimming birds are usually set well back on the body. This position, plus the webbed feet, gives the bird an awkward waddling gait on land but the rear position of the feet makes steering in the water easier. Compare the position of the rudder of a boat.

Children's Activities

(1) Make a drawing of the head and beak of a thrush and of a sparrow.

(2) Name as many birds as you can which live chiefly on seeds.

(3) Make a list of birds which live chiefly on insects and other live creatures.

(4) Draw the foot of a bird of prey, a scratching bird, and a swimming bird.

(5) New words learnt: burrow, egg tooth, prey, forceps, etc.

(6) Make a booklet about the homes of birds; in it make drawings of their homes and describe them.

(7) Make a booklet called "Bird Friends"; in it write the names of the birds you know best and like best.

II. Insects

Required: Flies in specimen tubes. Large picture of house-fly (see Plate VIII).

Lessons on insects for age 8+ may be almost entirely confined to studies of the common house-fly. The chief lesson to be learnt here is the association of flies with dirt and disease. At the same time the theme of kindness to all God's creatures should be presented in this as in all other lessons on animal life. Some young children appear to have a natural tendency to mutilate flies by tearing off wings and legs. Efforts should be made to replace this tendency by a more benevolent spirit. For our own protection "death to the house-fly" has become the slogan, but we have no right to attribute malicious intent to a creature which is only fulfilling its destiny.

Glass specimen tubes or aspirin

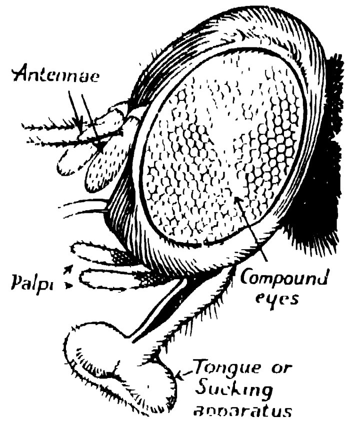
tubes make excellent observation cases for flies. A fly is placed in the tube with a few grains of sugar and the tube closed with a perforated stopper. It may be possible to provide each child in a small class with a specimen, but in larger classes the tubes will have to be passed from hand to hand amongst groups of children.

The first observation will be the method of feeding. A fly has no teeth and can only take in food in a liquid state by means of its trunk. How, then, does it feed on solids such as sugar? A liquid is exuded from the trunk on to the food and the resulting solution sucked up. Putting the matter crudely, the fly first spits on the food and then sucks up the spittle, but may leave some behind to contaminate the food.

As flies feed also on garbage, decaying refuse, and other kinds of filth, they may fly from the garbage heap to the bread, sugar, jam, or milk, carrying to the food filth and perhaps disease germs on trunk and feet.

Cholera, dysentery, typhoid, and summer diarrhœa are all said to be spread by flies. Hence the importance of keeping food covered in warm weather when flies are about. The meat safe, the muslin milk-jug cover, and other food protectors may be mentioned. The idea of repugnance to food which has been soiled by flies coming from a refuse heap may be cultivated, but the wise teacher will be careful to maintain a sense of proportion in this matter. There is a slight danger of an over-impressionable child becoming a trial to his parents by refusing all food on which he has seen a fly alight, but this danger is very rare.

How does a fly walk on the ceiling? Observe the fly in the specimen tube.



HEAD OF HOUSE-FLY.

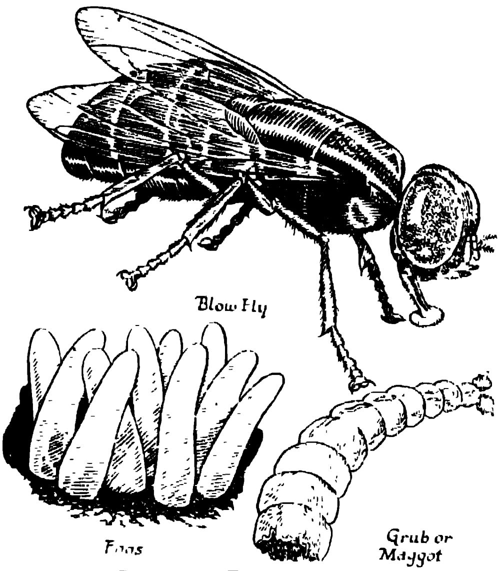
The feet are like knobs, and on close observation prove to have two claws and two hairy pads. These pads exude a small amount of sticky substance which holds the fly to the ceiling. There are no suckers on a fly's feet.

Life-history

There are big flies and little flies. Do the little flies grow into big ones? Are there any baby flies? The statement may be made that there are no baby flies and that small flies remain small. A fly is always adult and remains the same size until death. Where do flies come from?

During warm summer weather the metamorphosis of a blow-fly or bluebottle can be demonstrated. A piece of meat is exposed for a few days until it becomes maggoty. It is then placed in a large glass jar closed by a cork or a glass plate; an ordinary glass jar with its cover plate is suitable.

In five or six days most of the maggots will have turned into pupæ, and a week later the pupæ will become bluebottles or blow-flies. The life-history of the house-fly is the same as that of the



BLOW-FLY, EGGS, AND GRUB.

blow-fly, except that whereas the blow-fly lays her eggs on meat or on the bodies of decaying animals, the house-fly lays eggs in dung heaps, dirt heaps, or anywhere where there is accumulated dirt. A single fly lays from 100 to 150 eggs at a time, and during her lifetime may do this up to twenty times.

The eggs hatch quickly in warm weather, but the last batch laid as winter sets in may remain for three months before hatching. The grub or maggot which hatches from the egg feeds on the refuse until fully grown (about a week). The grubs have neither legs nor wings. The full-grown grub develops a hard, shiny skin and becomes a pupa or chrysalis. This is the resting stage during which there is neither feeding nor movement, but great internal changes are taking place. When these changes are complete, the cocoon splits open and the imago or perfect insect, in this case the fly, emerges.

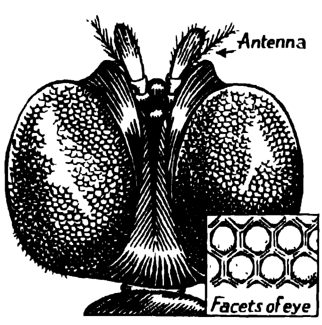
The pupal stage has a duration of a week in summer, but in many cases lasts throughout the winter. The four stages—egg, larva (grub, maggot, or caterpillar), pupa, imago—are typical of insect development. Most flies die off as winter approaches, but some may hibernate. Winter is, however, passed usually in the egg or pupal state.

The lesson to be drawn from this study is that cleanliness is necessary in order to keep down the number of flies. Since dirt, and especially decaying food, provides a good breeding-ground for the fly maggots, care must be taken not to leave food uncovered in warm weather. Crumbs, tea leaves, and other scraps must be swept up regularly. A dirty house is usually a fly-infested house.

During spring-cleaning, all corners, ledges, and hidden places must be carefully dealt with, as by this means many eggs and pupæ left from last season will be destroyed before they have time to develop.

What is an Insect?

Examination of the house-fly shows the body to consist of three parts attached to each other by slender joints. These parts are the head, thorax, and the abdomen or tail. The head carries the feelers or antennæ, the eyes, and the mouth. The thorax carries the



EYES OF FLY.

wings (one pair in the fly, two pairs in some insects) and three pairs of legs. The abdomen has no visible appendages, but some insects have an ovipositor or egg-laying tube, modified in some cases to act as a sting.

The three-sectioned, jointed body is typical of all insects. A spider (eight legs and two-sectioned body), is not a true insect.

Children might be asked to decide whether certain creatures, commonly called insects, such as the spider, centipede, etc., are true insects or not. They will then learn to look for the three-part body, with the six legs and the wings on the middle part.

The four stages in the life-history of the house-fly are typical of most insects:

(1) egg; (2) larva (grub, maggot, caterpillar); (3) pupa (chrysalis, with or without covering cocoon); (4) imago (perfect insect).

Flies have large compound or faceted eyes. It will be sufficient if children are told that each eye is divided into about two thousand parts, each part acting like a separate eye. Thus a fly can see in nearly every direction, and whilst in flight can see objects both before and after passing them. The facets cannot be seen through a magnifying-glass, but only through a powerful microscope.

Children's Activities

(1) New words learnt: larva, grub, maggot, pupa, chrysalis, thorax, abdomen.

(2) Draw three circles touching one another to represent the three parts of a fly's body. Draw in the wings, legs, eyes, and trunk.

(3) Baby spiders are sometimes seen, but never baby flies. Why is this?

(4) When boys or girls go to camp in summer, they are told not to leave any scraps of food lying about. What is the reason for this?

(5) Make a booklet about "Insects"; in it write the names of insects as you learn about them or find them yourself. You know these insects so far—fly, bluebottle.

III. Plant Life

The study of plant life may commence with the examination of flowers, but as the summer term is the obvious time for this it may be found necessary to deal with twigs and buds of trees in the spring term. Flowers, however, will make a greater appeal to children, and once their interest is aroused they will be more ready to show interest in other forms of plant life.

The Parts of a Flower

Required: A bunch of buttercups, some in the seeding and some in bud stage. These are usually available from February to October. Large diagram of a sectioned flower; for example the fuchsia, to show clearly pistil, stamens, etc. (see Plate IX); if possible, magnifying-glasses.

Give each child a buttercup to examine. Let the children pick out the different parts, starting at the top of the stalk.

Note the five small green leaves forming a cup at the top of the stem. The green leaves are called *sepals,* and the cup they form is called the *calyx*. What are they for? Examine a bud. Here the sepals are closed up over the bud and protect it from rain, wind, and cold. In the open flower the sepals can be pulled off one at a time without hurting the rest of the flower.

Next come five more leaves, yellow

in colour and bigger and softer than the sepals. These are the *petals* and form the corolla (this last word can be omitted in a first lesson).

Carefully pull off a petal and examine it. It is soft and of velvet smoothness, and at the base on the upper side is a small patch of nectar. Refer here to bees and other insects. Let children taste the nectar by licking the base of a petal. Mention the colours of petals of other flowers, white, red, blue, etc. The scent of a flower lies in the petals, but a buttercup has little scent.

Next pull off all remaining petals and examine the *stamens*. These are numerous and small, but can be identified even without the magnifying-glass. However, if a larger flower, such as a poppy or lily, is available, the stamens will be more easily seen. Each stamen consists of two parts—a stalk or *filament* and a yellow swollen top called the *anther*. The anthers contain *pollen* dust. Ripe anthers will have burst, and it will be possible to shake out the pollen dust on to a sheet of white paper. Examination under the magnifying-glass shows it to consist of tiny yellow grains. What is the use of the pollen?

BUTTERCUP, SHOWING FLOWER AND CARPELS.

First let us look at the remaining part of the buttercup. In the centre, rather higher than the stamens, are some pale-green rounded objects with pointed tops. These are the *carpels*, and are made up of the *ovary* or seed-box at the bottom, the *stigma* or spiky, sticky top, and the *style* joining the two. (*Note*: the style is not very evident in the buttercup, but can be seen in the fuchsia (Plate IX); it may be wise at this stage to use only the terms "stigma" and "seed-box," to avoid confusion.)

In some flowers the stigma is carried at the end of a long stalk, as on the fuchsia (Plate IX), and in others, for example the poppy, is spread all over the top of the seed-box.

Explain that the stigma, style and ovary are called the pistil, but sometimes there is little or no style as in the buttercup.

Formation of Seeds

When a grain of ripe pollen falls on the top of the stigma, a slender tube called a pollen tube grows down from the pollen, through the stigma to the ovary. Until the ovary is thus fertilized the seed does not form.

Some plants have two different kinds of flowers, one flower with stamens only (the male flower) and the other with stigma and seed-box only (the

female flower). The vegetable marrow is an example of this type.

The question of cross-pollination and of different pollen-carrying agencies may arise, but a fuller study of this is best left until a later stage. Having become familiar with the parts of a buttercup, the children will be able to look for the various parts of other flowers they come across.

The compositæ, daisies, dandelions, etc., will be bound to trouble them, especially as many garden flowers are of this type, and the teacher will be called on to make some explanation of the variation. This should be done with as little detail as possible. A single daisy can be described as many tiny flowers joined into one.

Children's Activities

(1) New words learnt; sepal, calyx, petal, corolla, nectar, stamen, filament, anther, pollen, stigma, ovary.

(2) Make a flower diary. Put the date when each kind of flower is first seen, the name of the flower, and its colour.

(3) Make drawings of as many different kinds of stamen and stigma as you can find.

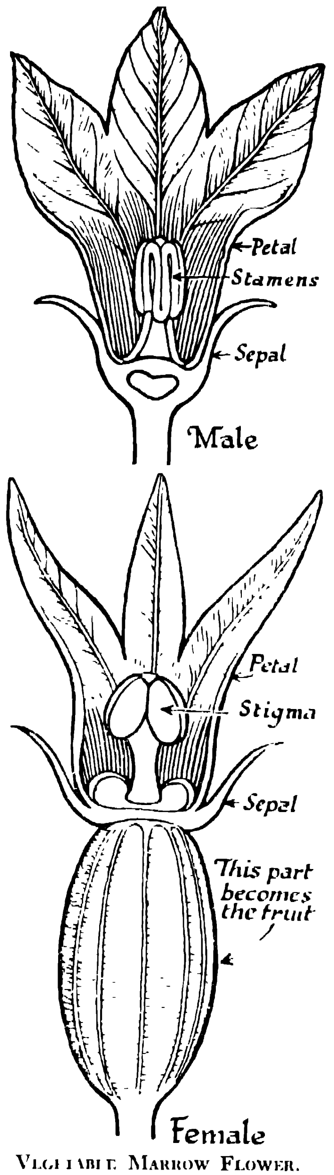
(4) Try to find a flower with the anther balanced on the top of the filament like a see-saw.

(5) Find out if sepals of all flowers are green. If not, make lists of flowers with white, yellow, and blue sepals.

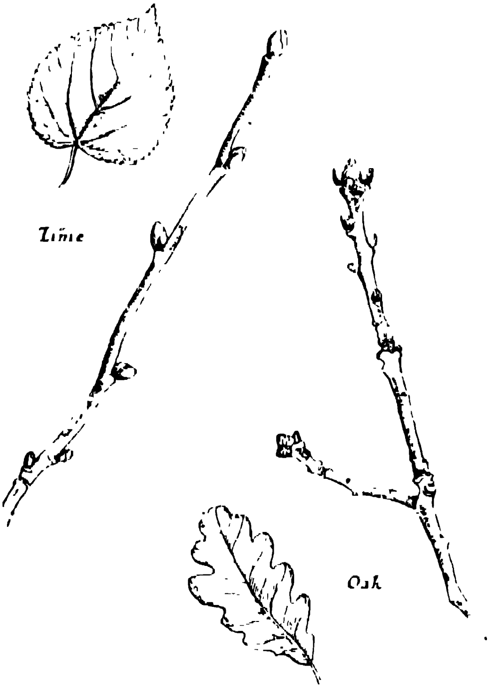
(6) In the English lessons, find stories and legends about flowers and trees. You will find some in *A Tale in Everything* (Univ. London Press).

(7) Make a catalogue of garden flowers, arranging the names in alphabetical order. Find some catalogues to study. Cut the pictures from them to make "Flower books" as in (8).

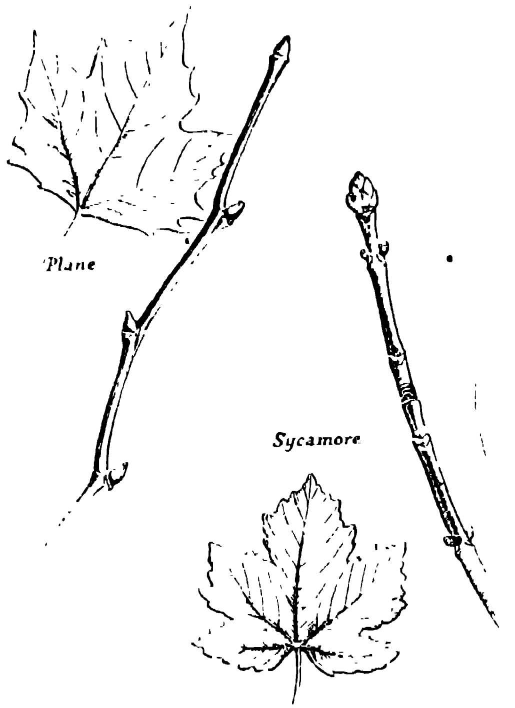
(8) Make booklets for spring, summer, and autumn flowers. Write the names of flowers that belong to each season in the right booklet. Draw pictures or cut them from flower catalogues.



VEGETABLE MARROW FLOWER.



ALTERNATE BUDS



ALTERNATE AND OPPOSITE BUDS.

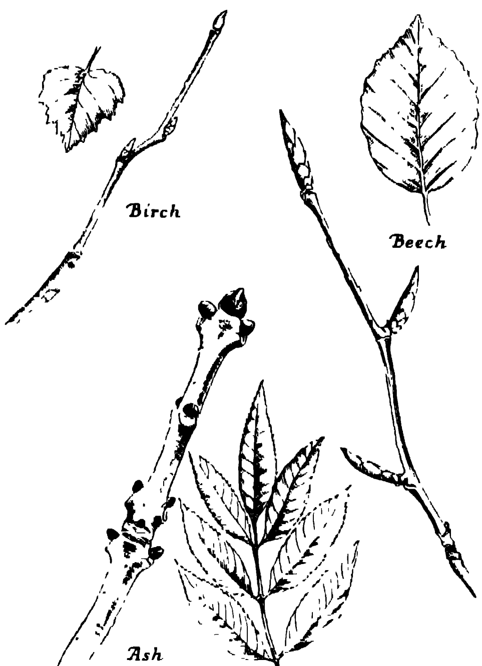
TREES (Plate V)

Early spring-time is the time to make collections of twigs. Some of these may be used for decoration in the classroom, and are then available for lesson purposes. Each child might be encouraged to make a twig book, the twigs being fastened to the leaves of the book with strips of gummed paper, or by lightly smearing the backs of the twigs with gum. Room should be left on each sheet for a leaf of the appropriate tree to be attached as these become available in later spring. Some teachers will like to have twig and leaf books made up in class as part of a practical lesson. This method will probably result in more satisfactory books.

If the work is suggested for out-of-school activity, the results are likely to be disappointing and will vary from the nearly empty and untidy book to the complete and neatly finished article that is obviously the work of an enthusiastic parent.

Whatever the method, twigs should be available in the schoolroom for the children to handle and observe. They may be set to draw some of the twigs and notice the similarities and differences in the different kinds. They will quickly learn to identify the buds and twigs of the well-known trees, such as horse-chestnut, beech, ash, oak, lime,•sycamore, plane, birch.

They will notice that all the twigs have a bud at the end and several others along the sides. Why are the buds spread out like this? These buds will later open into leaves, and each leaf will get its share of sunlight; this



ALTERNATE AND OPPOSITE BUDS.

would not happen if the buds were close together.

If many kinds of twigs are available for examination, it will be noticed that in some cases the buds are placed in pairs on opposite sides of the stems, and in others alternately. Opposite: chestnut, sycamore, maple, ash. Alternate: beech, poplar, birch, oak, lime, plane. Note also that in twigs with opposite buds each pair of buds is arranged at right angles to the previous pair, thus producing a better leaf mosaic and avoiding shading of one pair of leaves by the next.

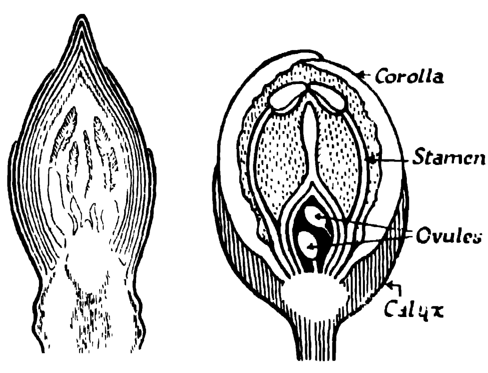
Recognition of Twigs and Buds

The horse-chestnut is easily recognized by its large sticky buds with the horseshoe-shaped leaf scar under each. Buds of the sycamore, maple, and plane can be distinguished; the sycamore bud is green, while that of the maple is reddish-green. The plane bud is greenish-brown, and the buds are alternate. Ash buds, dark in colour, are thick at the base and almost pointed at the top, and remind one of the hoof of a deer.

The long, slender bud of the beech, with its tightly packed scales, and the dark-red buds of the poplar are easily picked out. Oak buds are bright brown and clustered closely together.

Twigs freshly gathered may be placed in jars of water in the classroom and will probably burst into leaf in the warmth of the room before the twigs on the living tree show signs of life. A horse-chestnut twig with a large terminal flower bud should blossom under the same conditions. Children can watch the gradual softening of the gummy covering of the chestnut leaf bud in the warmth of the room. In the winter this gummy covering is hard and shiny and protects the incipient leaf or flower.

If a chestnut bud is carefully pulled to pieces, the following layers are noticed: (1) The outermost layer, thick brown scales, sticky on the outside, greenish inside. (2) Green scales with brown sticky tips. (3) Green scales, per-

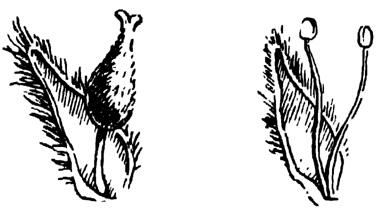


BUDS OF HORSE-CHESTNUT

haps with white hairs on top. (4) A white fluffy layer like cotton-wool; with care this fluffy layer can be divided and picked off in pairs like the scales; they are the young leaves. (5) If a leaf bud, a small mass of fluff (leaflet). If a flower bud, a thimble-like lump pale pink in colour (the future flower).

The white fluff in both types of bud serves as a protection against the cold of winter.

The study of the horse-chestnut bud serves to emphasize a point that continually obtrudes itself during the study of Nature, namely, the way in which provision is made for the care and protection of the young. The human mother tends and protects her baby, birds cherish and protect their young, the young tadpole is protected by the covering of jelly until he is old


FEMALE AND MALE FLOWERS OF CATKIN.

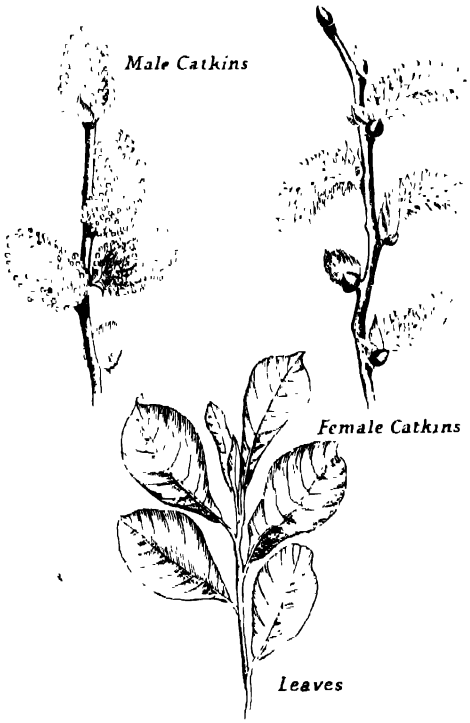
enough to look after himself, the male stickleback cares for the young fish, and in the bud of a tree the young leaves or flowers are protected from the rigours of winter.

Later the children will have more proof of parental care for the young when they deal with the baby plant in the seed. Some moral teaching is possible in these connections.

With the approach of Palm Sunday comes an interest in the pussy palm or pussy willow, and collections of the silver pussy catkins and the golden-anther catkins may be made. Children will be told that although the twigs are spoken of as palm branches, they are not palms at all, but twigs of willow.

Incidentally, the teacher will do well to note that there are many varieties of willows with such differences that identification is frequently difficult. In general, the willows have long, slender leaves and erect catkins, but there are divergencies from this rule. The so-called palm catkins are found on the sallow or goat willow.

Children who collect the catkins should be encouraged to note that some of the trees have only golden catkins and others only silver ones. Let the children examine the golden catkins, if possible with the aid of a magnifying-glass. They will see that the golden mass is made up of tiny flowers, but when they attempt to pick out the different parts of each flower they find



PUSSY WILLOW.

that there is no calyx, no seed-box nor stigma, but only a pair of stamens and a scaly leaf. In other words, it appears to be only half a flower. The scaly leaf has a patch of nectar at the base.

An examination of a silver catkin flower shows this to consist of only a scaly leaf with a nectar patch, and a seed-box with stigma, the other half of the flower.

Question: how does the pollen get from the stamen of a golden male flower to the stigma of a silver female flower? In March, when the catkins are in flower, there are not many other flowers about, and swarms of bees and moths visit the catkins in search of honey and pollen, thus assisting in fertilization.

The sallow willow is a notable exception to the general rule that catkin-bearing trees, willows, poplars, oaks, beeches, birches, etc., depend on wind-carried pollen for fertilization, and have no nectar patch to attract insects.

Children's Activities

(1) New words learnt: catkin = little cat or kitten, terminal, alternate.

(2) Can you think why pussy willows are called palms, although they are not palms?

(3) During your walks in park or country keep your eyes open for catkin-bearing trees. Make a note of the name of the tree, the date the catkins appear, and whether the catkins come out before or after the leaves.

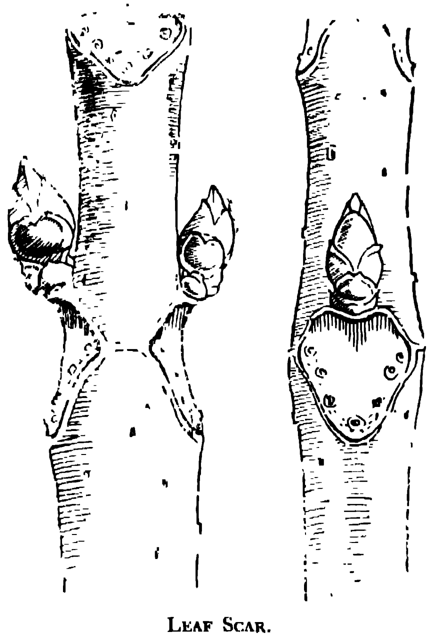
(3) Make a twig book in spring. Put one twig on each page, and later when the leaves come out on the trees, put on each page a leaf from the same tree as the twig. Be sure to put the name of the tree under each twig.

Autumn Leaves

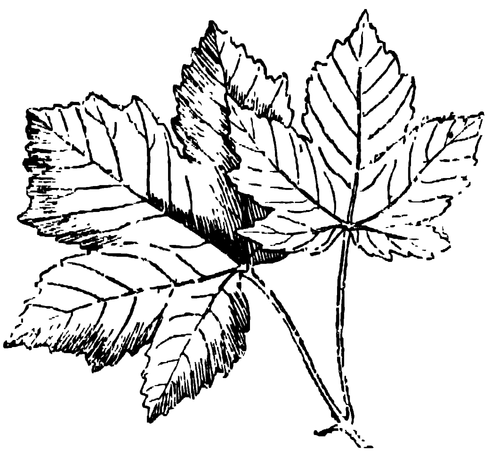
With the passing of the summer the glut of subjects for outdoor Nature Study has been exhausted, but the advent of the golden-brown tints of autumn suggests that the study of leaves and trees is not yet finished.

Here is a chance to consider the division of trees into deciduous and evergreen, or, in the language of the child's mind, trees that are bare in winter and trees that are not. In some countries autumn is spoken of as the "fall," and this is a term children will readily appreciate.

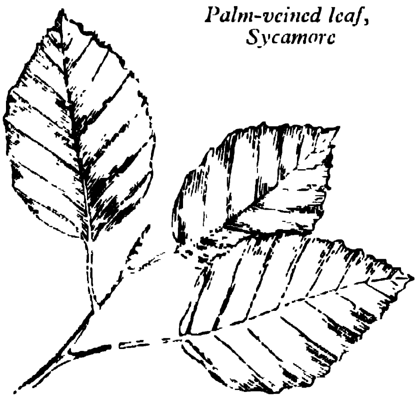
The answer to the question, "Why do some trees lose their leaves in autumn?" cannot be given with complete satisfaction to every child, but most children will be ready to acknowledge that winter is Nature's resting period. If they conjecture at all on the reason for trees having leaves in summer, they will probably decide for



LEAF SCAR.



Palm-veined leaf, Sycamore



Feather-veined leaf, Beech

VEINS ON LEAVES.

themselves that leaves make the tree look nice and also give shade and shelter. There the matter should be allowed to rest, as a consideration of the function of leaves should come later.

Water is needed to keep leaves fresh and green; note how freshly-gathered leaves lose their freshness unless kept with their stems in water. During spring and summer the roots are drinking in water from the soil, and some of this water, containing food from the soil and from parts of the plant, goes to the leaves. Refer back to early summer, when a leaf had to be forcibly pulled from its stem and in most cases left a wound from which a little watery liquid (sap) oozed for a time. Since this sap contains food from the soil, what a lot of food a tree would lose if all its leaves were pulled off in spring or summer.

But on the approach of winter the ground gets cold, and the roots, being chilled, are unable to send much water to the leaves. They are beginning to get ready for their winter sleep.

The Corky Layer

As the leaves become short of water they shrivel and die, and eventually the dead brown leaves fall or are blown off by the wind. But before this happens a layer of cork begins to grow between the base of the leaf-stalk and the stem. This corky layer seals up the wound, so that when the leaf falls no sap is lost.

Let the children examine the twigs from a twig book in order to find the leaf scars. Each scar will be just below a bud, for next year's bud grows in the axil of the leaf, i.e. in the angle between the leaf-stalk and the stem.

What happens to the leaves which fall? They lie on the ground and decay, eventually mixing with the soil to form the valuable leaf-mould in which so many plants grow well.

Children should be encouraged to look for skeleton leaves among the debris. The veins are tougher than the rest of the leaf and are the last to decay. Few perfect skeletons will be found, but good skeletons may be made by soaking a leaf in caustic soda solution (see page 151).

Skeleton leaves are not really necessary for the study of veining, as the principal veins can be seen in most large whole leaves. (See page 151 for

making of a vein print.) Some leaves are palm-veined (sycamore, maple); and others feather-veined (beech, oak). The reason for the terms is evident.

Simple and Compound Leaves

Leaves of the horse-chestnut and the rose are said to be compound, that is, they are divided into a number of separate leaflets. Leaves not so divided, e.g. privet, are classed as simple leaves. Children sometimes confuse leaflets of compound leaves with actual leaves. Once the fundamental difference is pointed out they should have no difficulty. There is always an axillary bud at the junction of a leaf-stalk to the main stem, but there is no bud at the base of a leaflet stalk. (See Plate V.)

Evergreens

Holly trees and Christmas trees will come to mind as examples of evergreens. Leaves of holly, laurel, and privet may be examined. They are found to have hard, shiny surfaces. Leaves of the various conifers may also be considered. Besides being hard and smooth, they exhibit a very small surface to the air. As the subject of transpiration from leaves has not yet been dealt with, it will be politic to say at this stage that evergreen leaves can do with very little water, and so even in winter the roots can supply sufficient to keep them alive.

It must be pointed out, however, that evergreens are not trees that never lose their leaves. The old leaves fade and fall off, perhaps after a year or two, but new leaves are always growing to take their places. Children who have walked on a carpet of pine needles in a wood will have collected evidence of the fall of some leaves from evergreens.

Parks and gardens provide plenty of examples of evergreen trees and shrubs. Children will probably realize that this is because such trees provide a decorative effect in winter when other trees are bare. They may also like to know that a Christmas tree is usually a spruce fir (Plate V).

Children's Activities

(1) New words learnt: fall = autumn, sap, corky layer, leaf scar, palm-veined, feather-veined, leaflet, etc.

(2) If you have made a collection of pressed leaves during the summer, look through this list and write down the names of all the simple leaves and all the compound leaves.

(3) If you can find a leaf with well-marked veins, try to make a vein print of it in the way your teacher has shown you (see Chapter VI).

(4) Make a list of six trees which are bare in winter and six which are not.

(5) Make a booklet about trees. In it draw or paste pictures of your favourite trees or trees you know well. Write notes about each.

(6) Draw all the different-shaped leaves of trees that you know. Paste your best drawings in a booklet called "Leaves of Trees."

IV. Related Science

The Motion of the Earth

Already, from the first-year lessons, the children have some idea of the earth as a revolving ball and are now ready for further details, including the motion of the earth round the sun. A recapitulation and extension of previous talks on early ideas of earth and sun provides a good starting-point. A

good story-teller with a sense of the dramatic can give these talks not only interest but a distinct cultural value.

Here, in brief, is the story of the gradual growth of astronomical knowledge.

At one time people thought the earth to be flat, with water all round the edges. (See Volume II, HISTORY.) The sun was a ball of fire which rose each morning in the east, circled overhead, and descended into the western sea at night. Vulcan (Roman god of fire) fished it out each evening with a pair of tongs, placed it in a golden bowl, in which it sailed round to the east during the night, ready to rise next morning.

In those early days people sometimes wondered what held the earth up, and many strange tales were told to account for its apparent stability. The ancient Hindu idea was that the earth was supported on the backs of four elephants, which in turn stood on the back of an immense tortoise, but on what the tortoise stood was not revealed.

In later times, when men realized that the earth was round, the sun was regarded as a lamp which circled round the earth. Naturally, they thought that the earth on which they lived was the most important body in the universe and the sun only a servant of the earth.

Then a man called Copernicus (1530) said that the sun was the centre of the universe and that the earth went round the sun. He even wrote a book about this, but nobody believed him and nearly everybody continued to think as before.

Nearly a hundred years later Galileo, an Italian philosopher, stated that Copernicus was right, and that the sun and not the earth was the centre of the universe. Although Galileo was known to be a very clever and able man, the authorities said he was trying to teach people what was not true. They even put him in prison, and only set him free on condition that he owned to being wrong. In spite of his recantation, due to age and infirmities and the persuasions of his friends, Galileo knew that his view was the correct one, but it was many years before the truth of his statement was accepted by the world at large.

Notes: Copernicus (1473–1543), born at Thorn, Western Prussia, was first a priest, then a doctor, and finally military governor of Frauenburg. Wrote a treatise containing his views in 1530, but delayed publication until 1543. The book was subsequently placed by the Roman Catholic Church on the list of prohibited books (1616), as being subversive of truth. *Galileo* (1564–1642), born at Pisa. In 1583 established the fact that a pendulum of fixed length oscillated uniformly regardless of amplitude of swing. Professor of Mathematics, Padua, 1592–1610. Constructed a telescope 1609, and picked out four satellites of Jupiter. In 1610 came under the patronage of the Grand Duke of Tuscany and moved to Florence. Indicted by the Inquisition 1616. Recanted his statement about the earth's motion 1632. (See HISTORY, Volume II.)

Why did people make the mistake of thinking that the sun moved and the earth stood still? Even to us the sun appears to move from east to west. Why?

Most children have been in a train at a station when another train close by has been drawing slowly out. They will remember that sometimes they

have thought that it was their own train that was moving whilst the other stood still, and vice versa.

Now they can be told that the earth spins round on its axis. Let all the class stand up. Each child looks at a window or other large object on his left. Now all children slowly turn round until they are facing the window (i.e. the window is now in front of them), and continue to turn until the window is on their right and finally behind them. Then as they complete the turn the window comes into view (as the sun rises) on their left again. The window represents the sun, and each child separately represents the earth.

A lantern or bicycle lamp may be shone on to the school globe in a darkened room. As the globe is gradually revolved, the children see that one half is illuminated (day) and the other half dark (night). They will also by this demonstration see which countries at any one moment experience sunrise and sunset. The terms axis, north and south poles, and Equator may be here introduced (see GEOGRAPHY, Volume III).

Now is the time when the inevitable question arises, why do the people in Australia not fall off the earth? The answer is rarely fully convincing. Children may be told that the earth attracts or pulls everything towards it. Thus a boy who jumps up is pulled back towards the earth. Also "up" always means towards the sky and "down" towards the centre of the earth. It is useless to discuss the force of gravity at this stage.

Most young children accept quite readily the statement that the earth is a ball or globe, and there is usually no need to stress the evidence in regard to this. The circular horizon, the appearance of the masts before the hull of a ship, and the circular shadows thrown by the earth on the moon during a lunar eclipse, are the common items of evidence given, but it is doubtful if children of this age see much connection between these facts and the shape of the earth. Perhaps the fact that a ship can sail right round the earth will appeal to them most. Such terms as "oblate spheroid" should be avoided; in fact the flattening of the earth at the poles need not be mentioned. The difference in the two diameters is only twenty-six miles and cannot be detected even on the largest of terrestrial globes.

Motion round the Sun

Put a lamp on a table in the middle of the room, or switch on a centre light. Let a boy walk slowly round the room, at the same time turning on his axis. The lamp represents the sun and the boy the earth. It will be seen that the lamp shines sometimes on the boy's face and sometimes on his back. In other words, all parts of his body periodically pass from night to daylight. Now establish the facts that the earth revolves once a day on its axis and travels round the sun once a year.

Sizes and distances may be mentioned. Diameter of earth = 8,000 miles. Circumference of earth = 25,000 miles (a train at sixty miles per hour would take more than seventeen days to cover this distance). Distance of earth from sun = more than 92,000,000 miles (the same train would require 175 years to travel the distance).

Children's Activities

(1) New words learnt: axis, poles, revolve, diameter, etc.

(2) On a sunny day place a stick upright in the ground. Measure the length of the shadow at 9 a.m., noon, and 3 p.m. Which way does the shadow point at noon? (*Note:* make allowance for Summer Time if necessary.)

(3) Measure the length of the shadow of a flag-pole or other tall object at noon in December, March, June, and September. (A card might be hung in the classroom to take these records, and comparisons made on completion.)

The Stars (see Plate X)

This is a winter study, and the short, dark days of November and December are most suitable. For safety purposes children in cities must be cautioned against standing in the roadway to observe the stars. In school, children can learn about the Great Bear (Wagon and Horses, or Plough). They can be asked to draw this constellation and then learn about the pointers (for pictures see Geography, Volume III). The line of the pointers continued for about three and a half times the distance between the two stars arrives at the North Star. Children already know how to use the sun by day to find the north, now they have a way to find the north by night.

Why are the stars seen best when there is no moon? Note that a lighted candle in a well-lit room, or a street lamp burning in the daytime, is hardly noticed. The stronger light of the moon makes the stars look dim. A fuller study of stars and planets should be left until next year.

The Moon

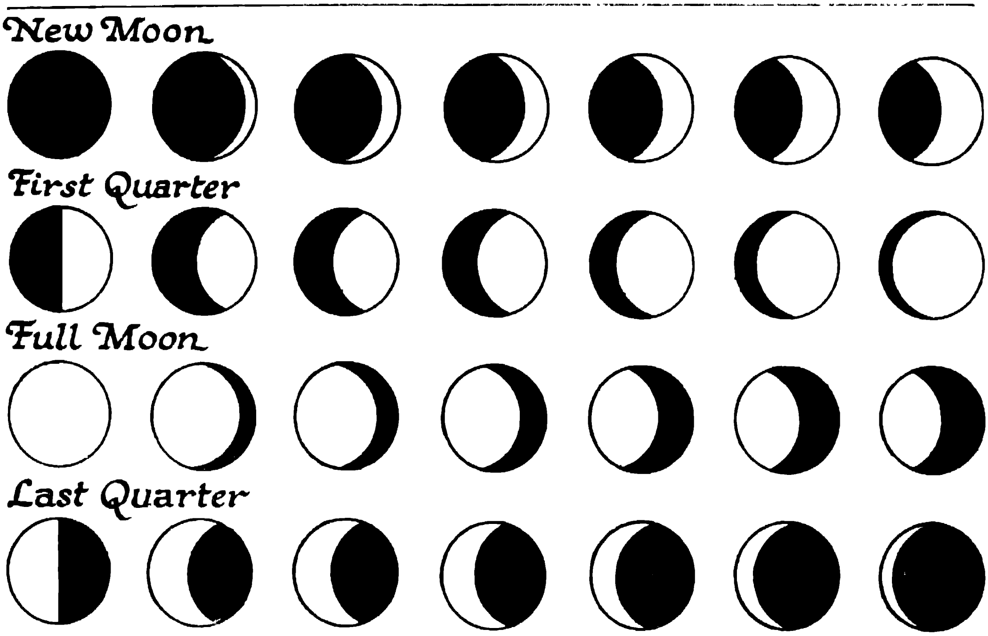
It is sufficient at this stage to deal simply with the moon as it appears in the sky. Children can learn about the phases of the moon. The new moon, seen as a thin crescent in the western sky soon after sunset, is the first phase. (Actually the new moon is invisible, except sometimes by earthshine, and the thin crescent appears a day or so later, but the crescent is popularly called the new moon.) Children might note that the horns of the crescent always point away from the sun.

As day by day the crescent grows bigger it rises later and stays longer in the sky. At weekly intervals we have the first quarter, second quarter or full moon, and third quarter. Only people who get up early see the third quarter and the later crescents of the old moon.

The terms " waxing " and " waning " should be learnt; also the fact of the four-week period. The similarity of the words " moon " and " month " (moonth) may be pointed out. If children ask about the man in the moon, they may be told that the moon is a round ball like the earth but much smaller, not so far away as the sun, only 240,000 miles, a distance equal to about ten times round the earth. The telescope reveals that there are mountains on the moon, and these at a distance are imagined to look like a man in the moon. Contrast the fiery glare of the sun with the cold, silvery light of the moon.

The Moon and the Weather

There is no evidence that a change of moon brings a change of weather. As, however, there is a change of moon once a week and weather in this country usually changes at least as often, it is easy to see why the idea persists in the minds of many people.



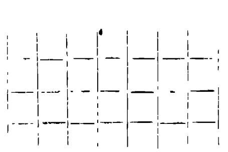
PHASES OF THE MOON.

Children's Activities

(1) New words learnt: constellation, crescent, waxing, waning, etc. Make drawings for words when possible.

(2) Draw a diagram of the Great Bear. Now try to draw the figure of a bear round your diagram. Draw two more diagrams, and see if this time you can draw a wagon and horses round one and a plough round the other. (The diagram in Volume III, GEOGRAPHY, will help the children.)

(3) Draw an oblong. Divide it up into four rows of seven squares each.



In each square, in order, draw the shape of the moon as it appears each night, starting with the new moon. Put down the date of the first quarter, full moon, and last quarter.

(4) Notice the shape of the first quarter. Why do you think it is called a quarter instead of a half?

(5) Find out from a calendar exactly how many days, hours, and minutes pass from one new moon till the next. Is this answer true for every month?

(6) For stories about the moon and sun see *A Tale in Everything* (London Univ. Press).

The Mariner's Compass

Recapitulate methods of finding the north, etc. How do sailors manage at night?

Show a bar magnet. Children will be more familiar with a horseshoe magnet, but they may be told that this is only a bar magnet bent until the two ends almost touch. After showing that it attracts pieces of iron, float it on a flat cork in a bowl of water, or hang it in a double hook made from wire and supported by a thread. Note that the magnet always comes to rest pointing

in the same direction, providing there are no masses of iron nearby. This direction is always North and South.

The end pointing to the north is called the north pole of the magnet (north-seeking pole). Show the mariner's compass. The bar magnet, in the form of a flat needle, is usually fixed to the card marked with the points of the compass, and so the north point is readily ascertained. Children may learn the points of the compass, with some intermediate points such as NW., NNW., etc. (See GEOGRAPHY, Volume III.) Magnetize a steel knitting-needle by stroking it with one end of a bar magnet, several times, always in the same direction. Show that this needle will now behave as a bar magnet. Place the needle on a stone sill and hit it several times with a hammer. Show that it has now lost all or nearly all of its magnetism. Hence deduce that great care must be taken of the mariner's compass.

Place a piece of iron near a suspended magnet, or near the mariner's compass; note the deflection. Discuss the danger to a ship of a faulty magnet or a compass deflected by a nearby lump of iron. If questions are asked about iron ships, it is sufficient to say that large lumps of iron are placed near the magnet to balance the effect of the iron of the ship. If small compasses are available, children may be given these to carry and then told to walk in various directions, e.g. ten paces west, six paces NE., etc. (See Volume III, GEOGRAPHY.)

Children's Activities

(1) New words learnt: magnet, magnetism, compass, magnetic needle, etc.

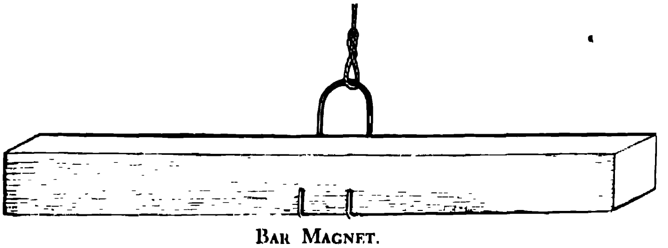
(2) Draw a picture of a mariner's compass and put in as many points as possible (for picture of compass see Volume III, GEOGRAPHY).

(3) A piece of iron, e.g. a spanner, is placed in a boy's pocket. A child carrying a small compass then tries to find out which boy has the piece of iron.

(4) For more about the magnet and some simple experiments, see *Projects for the Junior School*, Bk. IV, Chapter IX (Harrap).

FOG

A good lesson for a foggy day. Discuss the effects of fog: dirt, inconvenience, makes trains and buses late, tickles nose and throat. Why should we breathe through our mouths? Compare fog with a dust-cloud. Where does dust come from?—wear and tear of roads and pavements, smoky particles from fires, specks from clothing, blankets, and many other materials, salt from sea spray, pollen from plants. Dust is everywhere, more in cities than in the country. Some dust specks so small they cannot be seen. Is fog a kind of dust? A child breathes on the window-pane and forms a damp patch. Therefore breath is damp. Children may have noticed that on a cold day they make a little breath fog when they breathe out. Deduce that foggy days are generally damp and cold.



BAR MAGNET.

In cold, damp weather

each tiny invisible speck of dust may become covered with water and so become visible. All these water-covered specks make a fog. We can call a fog "water-dust." Many small particles, each with a thin layer of water=fog. Fewer particles, each with a thicker layer of water=mist. With a much thicker layer of water=rain.

Mention mist in the country, in river valleys morning and evening. When the sun comes out and warms the air, the mist disappears. Why? Why is there more chance of fog in a city than in open country? Why more mist in valleys than higher up? Why does fog make us dirty? Evidently because the specks of dust inside the water-drops stick to our clothes and skin. But why, if the specks of dust are always there, do we not get dirty when there is no fog?

Refer to a sandpit or the dry sand of the seashore. When the sand is dry we can trickle it through our fingers and on to our clothes and it does not stick. But if the sand is damp, or if our hands and clothes are wet, the sand sticks. Wet dirt sticks, dry dirt does not.

Is it a good or bad thing to have a lot of dust in the air? Danger to health: think of dusty trades—stone-cutters, miners, painters (when rubbing-down old dry paint), upholsterers, etc. Suction fan used to suck dusty air away.

Why are the streets watered in dry weather? Why does the school-cleaner sprinkle water or other liquid on the floor? Why does mother sprinkle damp tea leaves on the carpet before brushing? Which is best, to brush a carpet or use a vacuum cleaner?

Impress on the children the importance of keeping down dust. London fogs were once very bad, now they are not so bad because much smoke from factory chimneys is washed to free it from dust. Dust carries germs. No dust, no fog and less illness.

Note for the teacher, not for the lesson: In dust-free air there would be no twilight; there being no dust to scatter the light and reflect the rays of the sun from the upper atmosphere after sunset, day would suddenly become night when the sun sank below the horizon. Also light and shade would be more marked, and the transition from light to shadow would be sudden.

Fires and Burning

Required: Candle, lamp-glass, glass jar.

Who knows how to light a fire? Coal burns, so why use wood and paper? Coal burns, but is not easy to light. The flame of a match is not big enough and hot enough. So we put some dry wood under the coal. Wood lights more easily than coal, but is still hard to light with a match. So we put some paper under the wood. The match lights the paper, the burning paper lights the wood, and the burning wood lights the coal. Why is paper crumpled and wood laid loosely? If no draught, fire goes out. Establish that a draught is a current of air.

Experiment: Place a lamp-glass over a lighted candle, with three corks under the lamp-glass to give room for air to enter. The candle burns well. Remove the lamp-glass and cover the candle with a glass jam jar. The candle goes out. No draught, no burning.

Discuss types of fireplace. Usually there are bars at the bottom with spaces to allow air to enter. What happens when the spaces between the bars are blocked with ashes? How should a fire

be poked? If poked hard at the top, the coal may bed down and stop the draught. Poker should be inserted at the bottom and the coal gently lifted to allow ashes to drop out and leave air spaces between the pieces of coal. Discuss the use of dampers, also of slack coal put on a fire to stop most of the draught and cause the fire to burn slowly. Discuss the uses of fire. Cooking, warming, manufacturing. One difference between human beings and animals is that man uses fire and animals do not.

The dangers of fire. Fire is a good servant but a bad master. Things that take fire and burn easily are said to be *inflammable*. Petrol, benzene, methylated spirit, celluloid, etc. Children should be cautioned to avoid all inflammable liquids and never to play with matches.

Petrol and benzene are sometimes used to clean stains from clothing. This should be done by grown-up persons only, and never in a room with a fire or naked light.

Mention the comparative safety of gas or electric lighting compared with candles and lamps which may be knocked over.

Accidental Fires

How are these caused? Nearly always by carelessness. How to put them out? What to do if a person's clothing takes fire. Roll in rug and lay on floor. Why lay on floor? Because if standing up the rolled rug may act like the lamp-glass over the candle and cause a draught.

The Fireman and his Hose

Water puts out most fires, but not petrol and oil fires, because the burning liquid floats on the water and continues to burn. May be extinguished by sand or by smothering with a blanket or by means of a chemical fire extinguisher

Note: The flimsy material used for some dancing frocks may have been treated with a solution of a kind of gum to stiffen it. In many cases such treated material is inflammable and requires using with care. Even gas or electric fires require good guards when girls wearing fluffy frocks are near.

Children's Activities

(1) New words learnt: draught, damper, inflammable, etc.

(2) Describe how you would lay a fire so that it could be lighted at any time by applying a match.

(3) See if you can find out how people managed to light fires before matches were invented. (Savage and friction-stick, flint, steel, and tinder.) (See HISTORY, Vol. II.)

(4) If you were walking along a street and saw flames coming out of the window of a house, what would you do? (Answers might lead to talk on way to call Fire Brigade, and on dangers and expense of false alarms from a street alarm.)

(5) For projects on ways of lighting fires long ago, matches, wood fires and coal, warming the house, etc., see *Projects for the Junior School,* Books I–IV (Harrap). For legends about fire, see *A Tale in Everything* (London University Press).

FRESH AIR

Required: Model room (see diagram on opposite page.

This lesson should aim at impressing on children that air is necessary for living as well as for burning. The value

of fresh air and the need for open windows and good ventilation should be brought out.

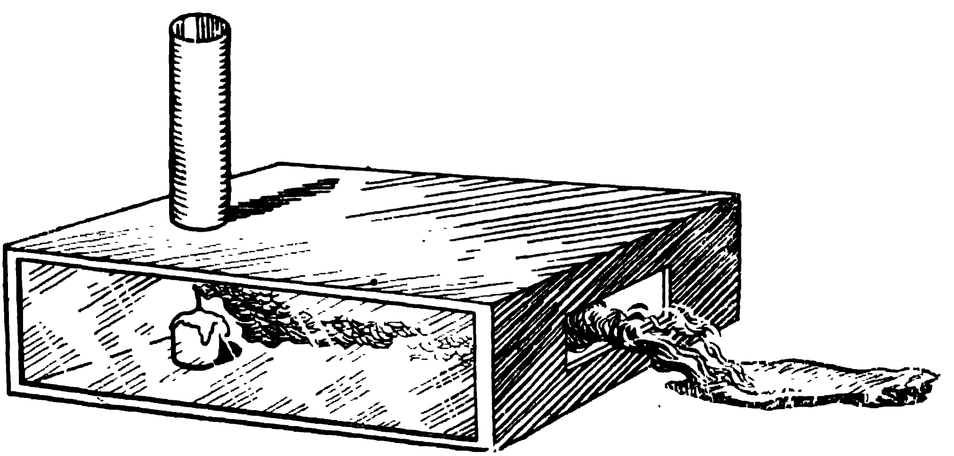
We have already talked about fires and fireplaces, but we have not thought much about chimneys. What are chimneys for? Obvious answer—to take the smoke away. Refer to houses in Norman times when fires were in the middle of the room and the smoke found its way out through a hole in the roof. (*Note:* These fires were wood fires; wood smoke is not so sooty as coal smoke.) Have chimneys any other use? Does the draught (or current of air) go up the chimney? If so, why?

Show the experiment with the model room. This is a glass-fronted box as shown in the diagram below. Smoke from a cigarette is effective, but if this is not considered suitable to a class of children, a roll of smouldering brown paper or blotting-paper may be used. This smoulders better if it has been previously steeped in a five per cent. solution of potassium nitrate (saltpetre) and subsequently dried. More realism is provided if a sliding cover is fitted over the window-hole. It is then possible to show that a window opened only a little way gives a draught.

The children can now see that smoke, and therefore air, goes in at the window, travels along the floor of the room until it gets to the candle or fire, and then goes up the chimney. Establish that the air near the fire becomes warmed and that warm air rises. So some air at least from the room goes up the chimney. Extinguish the candle to show that without a fire there is little or no draught up the chimney.

If air from the room goes up the chimney, then air from outside must enter the room either through an open window or door, or under the bottom of a closed door or window. Allow children to go and feel for the draught near the bottom of a door.

Thus a fire helps to ventilate, or change the air of a room. Discuss the effects of lack of ventilation: stuffiness, sleepiness, headaches. Probably the classroom has no fireplace, but if so, it will have one or more ventilators. Ventilators allow air to enter or leave a room. Usually, but not invariably, air enters by a ventilator low down on a



MODEL ROOM: A GLASS-FRONTED BOX.

wall and leaves by one placed higher up. Children can examine any existing ventilators and decide for themselves if air is entering or leaving.

Why is fresh air necessary? People must have air to breathe, and fresh air is better for us than breathed-out air. There is no harm in children thinking of expired air as bad air. There is no need to go into details about the mechanics of breathing, but instruction on breathing through the nose should be given. The habit of nose-breathing cannot be formed too early, and children who are unable to learn nose-breathing should be seen by a doctor.

A talk about sleeping with the window open should be given, and, in general, children should be impressed with the advantage both to mind and body of fresh air.

Children's Activities

(1) New words learnt: smoulder, ventilation, ventilator, etc.

(2) Suppose you had to send your dog by rail and needed a box to put him in. What sort of a box would you make? Try to draw a picture of the box.

(3) Why is it better to breathe through the nose than through the mouth?

(4) Draw a picture of a room with a fire in it. Show where air is coming in and going out.

SOIL.—A preliminary study.

Required: Two or three pounds each of silver sand and of modelling clay (not Plasticine). Ordinary sea or river sand will serve, and if modelling clay is not available, any stiff, heavy clay will do. Lamp-glass or wide glass tube.

The country child and the city child may have different views about soil. The country child regards the soil as an essential part of his surroundings and as part of Nature's economy, but the city child may think of soil simply as dirt. A preliminary talk about soil will bring out the children's ideas on the subject. This should be cut short as soon as possible by showing a heap of sand and asking for remarks. Sandpits in parks or at the seaside have probably made most children familiar with the sight of sand. Many will have seen it used by builders or road-makers.

An examination of the sand sample will show that it is formed of grains and trickles easily through the fingers. A magnifying-glass may be used to find out if all grains are alike. Sea sand will be found to have rounded grains, worn smooth by rubbing on each other under the moving action of the waves; river sand grains with sharp corners, as these are subject to little movement. Tie a piece of muslin over the end of a lamp-glass or similar wide tube. Fill this with sand and pour water in at the top. The water runs through quickly.

What happens to rain falling on a sandy soil? From the result of the experiment children will deduce, perhaps with some help from the teacher, that water drains quickly through sand, and this idea can be extended to a consideration of what happens to a sandy soil. Rain falling on sandy soil soon goes through the top layer, which rapidly becomes dry after the rain has ceased.

House agents sometimes advertise a house as being built on sandy soil. Why is this a good thing? Is a house on sandy soil likely to be damp or dry? What sort of foundations must such a house have? The answer will probably be that the builders must dig down until they

come to rock before they can lay the foundations.

The modern practice, if the rock is at a great depth, is to lay a thick bed of concrete on the sand and build the house on this. The concrete acts as a kind of raft which takes the weight of the building. In this case we can say that the builder makes his own rock for a foundation.

Deserts and other sandy places will be talked about. Vegetation is usually sparse on sandy soil. Most small plants, including grass, do not send roots down more than about six inches, therefore unless rain is frequent the top layer of sandy soil provides no moisture for plants, which wither and die. A garden with sandy soil requires watering frequently.

Experiment: Using the same or similar apparatus as before, fill the lamp chimney with well-packed dry sand and stand it with the bottom in a dish of water. Note that the water slowly rises and wets the sand to a height of about three inches, but rises no farther, even if left for a long time. Compare this with water or ink soaking up into a piece of blotting-paper held vertically with one corner in the liquid, or with oil creeping up a lamp wick. Show how water rises in narrow glass tubes, the smaller the bore of the tube the greater the rise. The little spaces between the sand grains act in the same manner as the narrow tubes. Introduce the words "porous" and "capillarity."

Ask the children if plants growing in sandy ground would get any benefit from water two or three feet below the surface. Only plants which require little water, or trees which can send roots to a great depth, flourish in sandy ground.

What plants do we find on sandy ground? Gorse and heather, which do not need much water; pines and larches, which also use little water, but have roots long enough to get what they require from deep down. Compare the words "heather" and "heath." Heaths are usually sandy places. The word "heathen" was formerly used to designate people who lived a wild and precarious life on the comparatively barren heaths.

Dry sandy soils are usually barren soils. Think of the sand dunes near the sea. The sand blown from the dunes may cover more fertile land inland. In some places trees and bushes which send out long roots are planted in the dunes to bind the sand together and also to act as a windbreak.

Shake or stir some sand in a jar of water. Notice that the sand quickly settles out again, leaving the water clear. Sand does not make water muddy. Call attention to any local rivers or streams with sandy beds. Is the water clear or muddy?

Clay should be considered in the same way as sand, and comparisons made. A piece of wet plastic clay should be shown. Clay may be white, red, brown, yellow, grey, etc. Note how slippery it is when wet; show or let the children demonstrate that it can be worked and moulded into any shape desired. Clay sticks together when damp. Compare this with a handful of damp sand.

Shape or mould a small clay brick, say about six inches by one inch by one inch. Using a gauge, made by driving two nails through a strip of wood, make two marks on the brick, say five inches apart. Set this aside to dry for a week over a radiator or in any warm, dry

place. When examined again it is found to be hard, and when measured with the gauge the two marks are closer together, showing that clay shrinks on drying.

Clay soil in hot, dry weather shrinks, and cracks develop. These fill up again when the rains come and the clay becomes soft and swells. Wrap the dry clay brick in several folds of cloth and keep this wet by daily watering or by leaving it in a shallow dish of water. Test the distance apart of the marks after the brick has become wet and soft again. It would be wise to avoid reference to building bricks, but if children ask about brickmaking the reply given would be that the dried clay bricks are "fired," i.e. heated in a very hot fire, and on cooling come out as hard bricks. Pottery is made in a similar way. Unless a muffle furnace is available, the firing of clay articles cannot be shown to a class. (See Volume IV, Clay Modelling and Carving.)

Does water run through clay? Put a little clay in a glass funnel and press well down. Pour water into the funnel and note that none goes through the clay. Try the same experiment with sand.

Shake up some clay in water in a glass jar. Allow to stand. Note that although some clay settles out, the water still remains muddy and may take many days to clear.

Take two tubes about three-quarters of an inch bore, open at both ends. Tie muslin over one end of each. Fill one with dry, finely powdered clay and the other with dry sand. Stand each in a dish of water. Note that although water runs more quickly up the sand column, it eventually rises much farther in the clay column. The rise of water in the sand column is complete in a few minutes, but continues for several hours in the clay column. Deduce that water would rise more easily to the roots of plants in a clay soil than in a sandy one.

A market gardener likes a sandy soil because it is easy to work and, being a

Sand	*Clay*
Large grains	Small grains
clean to handle	slippery and messy to touch
drains well	holds water
does not make water muddy, but settles quickly	makes water muddy and takes long to settle
dries easily	does not dry easily
easily becomes warm	remains cold
capillary action slight	capillary action great
easy to dig	hard to dig, rock-like when dry, heavy and slippery when wet.

Contrasting Properties of Sand and Clay.

warm soil, gives early crops, but the plants require constant attention in dry weather. Plants grown in clay soil need less watering.

An ideal soil contains both sand and clay, and is called loam.

Children's Activities

(1) New words learnt: porous, capillarity, loam, etc.

(2) Make small models in clay, try the same with wet sand. Note the difference on drying.

(3) Place a dry, small clay model in the centre of a red fire. Leave it as long as possible without poking. See if it bakes hard.

(4) Do you know what a potter's wheel is? A potter fashions a clay bowl on his wheel and then bakes it to turn it into pottery. Do you think he could do the same with sand? (See Volume II, HISTORY, for pictures of the potter's wheel, and the first people who found out that clay would not let water pass through it, and made pots with it. See also Volume IV, CLAY MODELLING AND CARVING.)

CHAPTER FOUR

MATERIALS, SUGGESTIONS, AND ACTIVITIES FOR THIRD YEAR'S WORK

WE are now approaching the stage when a rather more critical study of natural phenomena is desirable. Previously the lessons have dealt with the superficial aspects of Nature, with little regard for cause and effect. A few simple scientific facts may now be learnt and some ideas obtained of the inner working of Nature's manifestations. Simple ideas of heat and some of its effects, the nature of a thermometer, and the difference between melting and dissolving may be presented.

The physical properties of sand and clay have already been dealt with, and this knowledge can now be amplified by a practical study of soil. The importance of humus in soil must be brought out, and in a general way the parts played by sand, clay, and chalk in the making of a fertile soil may be dealt with. It is inevitable that the slow weathering of rocks to soil must be considered, but any detailed study of this should be avoided. Weather and rainfall should be studied in an introductory way.

It is desirable, but not essential, to deal with this part of the related science syllabus first, then go on to the study of plants, and afterwards to the study of insects and other living creatures. The lessons on astronomy may be given at any time, and it may be well to keep these, also the lesson on "time," for periods when Nature material is not available.

With regard to plant study, the functions of the different parts of the plant will be considered in such a way that children will be able to take an intelligent interest in the school garden, if such exists, or in the cultivated fields and allotments they may see. The greengrocer's shop will also take on a new aspect and may prove a source of demonstration material in the absence of a garden. The living creatures studied will be inhabitants of the soil or visitors to the garden, and a general idea of their anatomy and activities will be obtained.

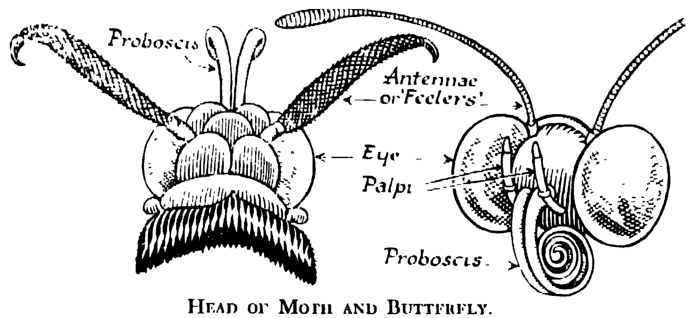
There will be no dearth of material for all these studies. The chief difficulty will be to fit in all the necessary experimental work during the time allotted to Nature lessons.

I. Butterflies and Moths

Required: Large coloured chart, showing common butterflies and moths (Portfolio, Plates XI, XII, and XIII). Collections of butterflies and moths, if available.

Since the butterfly is the last stage in

the life-cycle of the insect, it may appear illogical to start with the imago, but children are naturally attracted to the brightly-coloured, mature insects, and a study of these will probably foster an interest in eggs, caterpillars, and pupæ.



HEAD OF MOTH AND BUTTERFLY.

Some time may be spent in admiring pictures and specimens. Then the first question will be, "Which are butterflies and which are moths?" What is the difference? Probable answers will be that the brightly-coloured insects are butterflies and the drab-coloured ones moths; also that butterflies are seen in the daytime, but moths only at night. Neither answer is correct, as many moths are brightly coloured and many are seen in the daytime. In fact, many more moths are seen in this country than butterflies. Only about seventy kinds of butterflies are known here as against nearly two thousand kinds of moths. The distinction will be more evident after a detailed examination.

Refer to what has already been learnt in the second year about an insect. In the pictures or specimens, look for the three-part body. Note that here the segments—head, thorax, abdomen—are not so distinctly separate as in a fly or a wasp. Note the six legs and the wings, two pairs of wings in butterflies and moths. Here bring out the point that insects have no bones, but the body is supported and kept in shape by the skin, which is frequently hard and tough and plays a similar part to the skeleton in higher animals. We may say that little boys and girls have skeletons inside their bodies, but insects have the skeleton outside and the body inside.

The head carries eyes, mouth, and feelers or antennæ. Note that the feelers of a butterfly are "clubbed" or have bulbous ends, whilst those of the moth are pointed. This is one difference between the two types. Another difference is that a butterfly, on alighting, places its wings erect, back to back, so that only the underside is visible. Thus the brightly-coloured side of the wing is concealed and the insect is likely to be less visible when standing on a stalk or leaf. The moth, on the other hand, alights with its wings spread flat, leaving the upper sides visible. Even here, however, colour camouflage comes in, and a moth resting on a plant is often difficult to pick out. This colour camouflage probably protects both types to some extent from attack by birds.

Here a slight digression may be made to talk about colour camouflage in Nature. Mention the earth-like colour of the rabbit, the white coat of the


ANTENNÆ (MAGNIFIED) OF BUTTERFLIES AND MOTHS.

LARGE EYES AND COILED-UP TRUNK OF MOTH

polar bear, the protective colouring of young birds, etc.

Scales on the Wings

Probably children have noticed that when handling a moth or butterfly a fine dust may come off on the hand. This dust consists of some of the tiny scales which cover the wings. The scales are coloured, and the coloured patterns on the wings are largely due to the scales. With a magnifying-glass the head may be examined more closely. In addition to the antennæ, the large eyes may be noted, also the trunk or proboscis, coiled up when not in use. Moths and butterflies cannot bite or chew, but may use the trunk to suck up nectar from a flower. Why is the trunk so long? The large wing-spread may prevent the insect from crawling down inside a flower, but the long trunk makes the sucking of nectar possible.

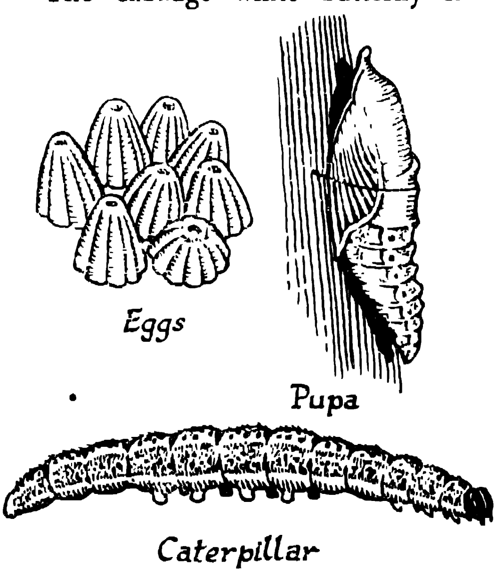
Children might be asked to name some common moths and butterflies. Amongst others, the clothes moth will be mentioned and also the cabbage white, one of the commonest of our butterflies. The housewife hates the clothes moth, and the gardener the cabbage white butterfly. Why? The clothes moth does not eat clothes nor the cabbage white the cabbages. But both lay eggs, and it is the creatures which come from the eggs that do the damage. This leads us to a study of caterpillars.

CATERPILLARS

Required: Some of the following—eggs of cabbage white, caterpillars, silkworms, pupæ (various stages, if possible in insect cages), puss moth caterpillar in cage with pieces of bark and strips of brightly-coloured cloth and paper. (Plates XII and XIII.)

In spring and early summer children will be able to provide both eggs and caterpillars for study. These can be kept in suitable cases with leaves of the host plant as food. Their progress and development can then be watched day by day. It will be necessary perhaps to remind children that insects' have a four-stage life: egg, larva, pupa, and imago or perfect insect.

The cabbage white butterfly is a

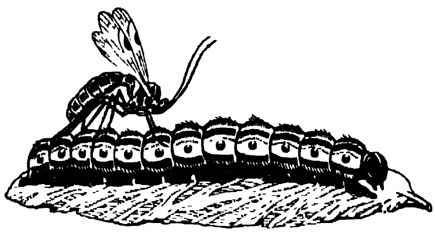


CABBAGE WHITE CATERPILLARS.

good example to take for the study of a life-history, as it is common in all vegetable gardens and allotments. The butterfly itself is easily recognized. The wings are white with a yellowish tint. The tips of the front wings are black, and the female insect has three black spots on the front wing. These are absent on the wing of the male.

In early summer the female lays her eggs in large numbers on the underside of the cabbage leaves. The eggs are slightly gummy when laid, and so adhere to the leaf. Why on the underside of the leaf? Think what would happen if the eggs were readily visible to birds in search of food. The eggs hatch out into caterpillars in about a fortnight. The little caterpillars at once begin to eat away at the leaf, sometimes leaving nothing but the ribs and veins. The caterpillar stage is the greedy stage, and as there is no feeding in the egg and pupa stages, and but little in the imago stage, the caterpillar has to lay up a store of food sufficient to see the insect through all the stages.

Note the parts of a caterpillar: the head, bearing a pair of eyes, short antennæ, and strong biting jaws. The thorax or front part of the body has three pair of legs, one pair on each of the first three segments. These are the true insect legs, and they will remain when the caterpillar turns into a moth. The abdomen (the part of the caterpillar behind the first three segments) contains many segments, more or less distinct according to the kind of insect; some of these segments have "legs," generally four or five pairs, not hard, horny, and jointed like true insect legs, but soft and cushion-like at the end, and unjointed. These are sometimes called "pro-legs," the last pair usually being



ICHNEUMON FLY.

modified as "claspers." With these the insect is able to grasp a stalk or the edge of a leaf. These pro-legs disappear when the caterpillar becomes a moth.

When the caterpillar is fully grown (in about a month), it ceases to feed, and spins a silken cocoon round itself which, as it dries, becomes a protective case. The insect then changes into a pupa or chrysalis. During the pupa stage there is neither feeding nor movement, but great internal changes are taking place. The caterpillar is slowly changing into a butterfly. The chrysalis of the cabbage white hangs itself to a fence or tree, but many types spend this stage buried in the soil or stuck in crevices. When the metamorphosis is complete, the pupa case splits and the mature butterfly crawls out.

The gardener does not like the cabbage white, because the caterpillars eat his cabbages. Similarly, the caterpillar of the clothes moth feeds on woollen and other material.

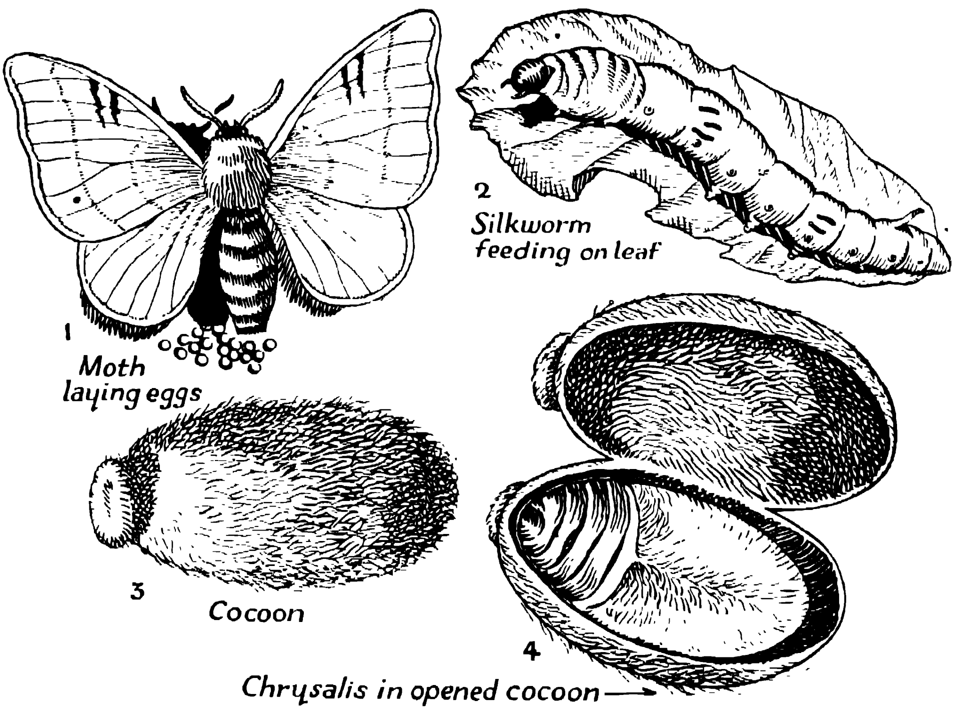
Children who are keeping caterpillars in a cage or box sometimes discover in the cage what they take to be baby caterpillars. As they have been told that caterpillars do not have babies, the finding of these small creatures is apt to mystify them. What look like baby caterpillars are probably maggots of the ichneumon fly. This fly is a great enemy of the caterpillar, for she is able to pierce its skin with her egg-laying

tube and so deposit her eggs inside the creature's body. In time these eggs hatch out into little maggots, which begin to feed on the flesh of the host caterpillar. In due course the maggots grow to their full size at the expense of their unwilling host, which now dies. The maggots eat their way out of the dead body and spin cocoons round themselves before entering the pupa stage, from which stage they evolve as ichneumon flies. The ichneumon fly is looked upon as the friend of the gardener.

Since caterpillars are such voracious feeders, they frequently do much harm to crops. There are, however, certain caterpillars that provide us with silk. Such are the caterpillars of the silkworm moth. Their principal food is the mulberry leaf, but they can live on lettuce if their natural food is not available.

As silkworms are not native to this country, they have to be bought from a dealer. The term " silkworm " is misleading, as the larva is a true caterpillar and not a worm. Natural silk is obtained from the cocoon by dropping it into hot water to soften the gum and then unwinding the silk.

If the caterpillar of the puss moth can be found on the bark of a poplar or willow tree, it may be kept in a box and fed on fresh leaves. The puss moth makes a cocoon by biting off pieces of bark and gluing these together with a kind of liquid silk from its body, so that the cocoon looks like a piece of bark. Captive caterpillars may be given a piece of bark to work on, in the hope that they will eventually produce a cocoon. Or if bits of coloured cloth or paper are pro-



LIFE-STORY OF SILKWORM.

vided, they may use this to make a many-coloured cocoon.

The codling moth is worth consideration in a lesson on caterpillars. All children are familiar with the maggoty apple, and specimens are unfortunately too easy to obtain. Children can easily learn to distinguish the apple damaged by the codling moth from that which has suffered from the ravages of the apple sawfly. The codling moth is quite small, about ¾-inch wing-spread, brown-grey in colour. The moth lays her eggs in early June on or near the young fruit. The young caterpillar, on hatching, crawls to the "eye" or calyx of the young fruit and burrows its way into the interior. There it lives for about a month, feeding on the apple core. When fully grown, it gnaws its way out through the side of the apple, finds its way into a crack in the bark of the tree and becomes a chrysalis.

A windfallen apple may be found with the caterpillar still inside, in which case the hole of entry will be seen, but of course no hole in the side of the fruit. If, however, an apple is found with a hole in the side but no hole in the eye, the responsible insect is the apple sawfly. The adult insect lays an egg on the part of the apple blossom below the calyx, and when the grub hatches, in about one to two weeks, it eats its way into the small developing fruit and lives there for four weeks or more, eating out a large space in the interior. The fully-fed larva then burrows beneath the soil below the tree and spins itself a cocoon; it usually spends the winter below ground, the adult fly emerging in late April or early May.

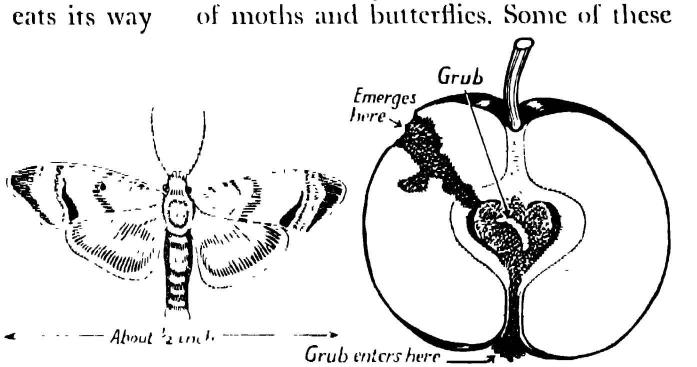
PUSS MOTH CATERPILLAR.

There is no difficulty in distinguishing fruits attacked by the codling moth from those damaged by the apple sawfly. The codling moth leaves two holes and a tunnel-like cavity where the core has been eaten. The sawfly leaves only one hole and a large irregular cavity. Also, apples attacked by the sawfly rarely attain any size, and usually fall from the tree in July.

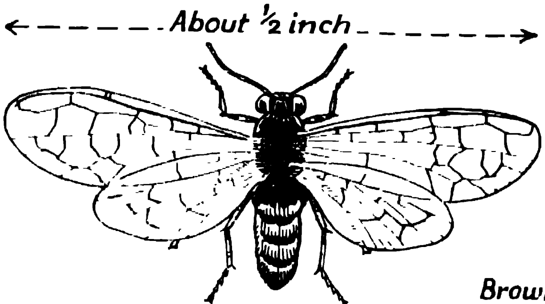
Children having access to fruit trees may be able to bring apples or pears with the caterpillar or grub still inside. The teacher can then cut the fruit across in view of the class and reveal the larva.

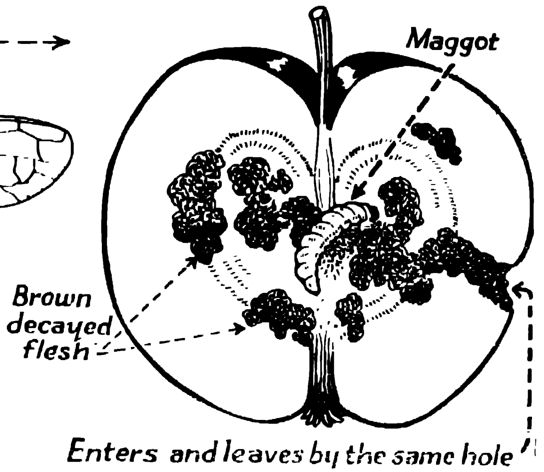
A fruit containing the codling moth caterpillar will have a hole in the eye, but no exit hole in the side. A sawfly grub in an apple generally causes an exudation of liquid from the hole of entry.

Children may bring to school cocoons of moths and butterflies. Some of these



CODLING MOTH





THE SAWFLY.

may develop into imagos in the schoolroom, but it is wise to be ready for disappointments, as a chrysalis removed from its natural resting-place may not mature, particularly if it has been dug up from the soil.

It is usually possible to distinguish the chrysalis of a moth from that of a butterfly. The moth pupa case is round and smooth, but that of the butterfly is angular and pointed.

Children's Activities

(1) New words learnt and old revised: chrysalis, pupa, cocoon, larva, antennæ, abdomen, thorax, imago, segment, maggot.

(2) Write a story about a butterfly, say what it does, and how its children grow up.

(3) A butterfly probably never sees its children. How does it make sure that they will not starve?

(4) Draw a butterfly and a moth, each resting on a leaf or twig.

(5) Make a booklet about butterflies. In it put the names of butterflies you have seen. Write a few notes about each. Choose one to draw and paint on the cover (see Plate XI).

(6) Choose your favourite butterfly and moth from Plates XI and XII. Draw and paint them. Find out all you can about them.

(7) Make a booklet about moths. The picture shows how the Death's Head moth gets its name. It is called "hawk" because it flies something like a hawk. You can get caterpillars of this moth from potato-growers. All moths are very fond of sweets, and abound in places where nectar-producing plants are in bloom. Their favourite flowers are: ivy, the sallow, honeysuckle, privet, nettles, pinks, and verbenas. Keep your eyes open for butterflies and moths. Watch for the flowers they like.

(8) Make in your note-book drawings of any caterpillars or pupæ that you can find, and colour them. Write underneath where you have found them.

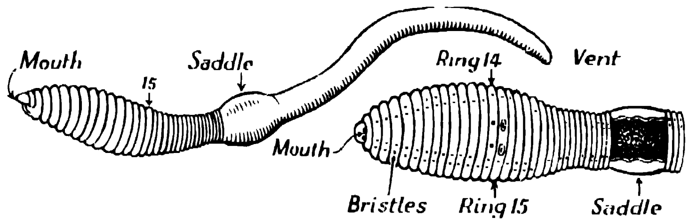
(9) What enemies has the caterpillar?

II. The Earthworm

Required: An established wormery with earthworms or some live worms, magnifying-glasses.

The earthworm is so intimately associated with the soil and with both plant and animal life that no teacher

of Nature Study can afford to ignore it. It is, moreover, a good subject for elementary study on account of its simple structure. It is possible in this lesson to introduce the subject of animal reproduction in an unembarrassing way.



EARTHWORM.

Where do we find earthworms? Generally in damp soil or other moist places. As a rule we only find them in the daytime by digging or by turning over flat stones or heaps of refuse. Worms come out to feed at night. Birds in search of worms must be up early before they burrow again into the ground.

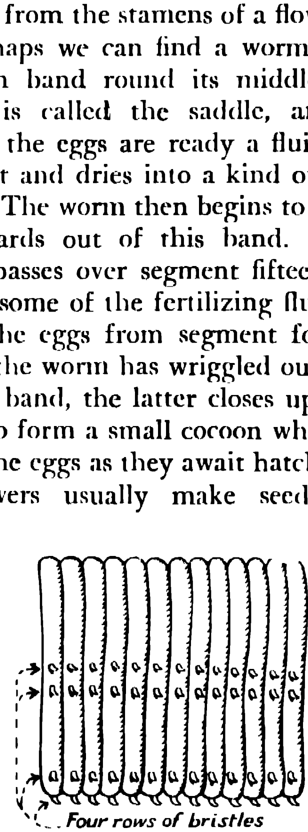
For examination, the fastidious teacher may have a worm in a closed test-tube which can be passed from hand to hand. The colour is usually reddish-brown on top and greyish-white underneath. How do we know which is the head and which is the tail? One way is to watch which way the worm moves, and the other is to know that the front part is round while the tail is flattish. The mouth is in front, and a hole at the other end is called the vent.

Notice that the body is made up of rings or segments, about 150 in all. Examine the worm through a magnifying-glass. On every ring except the first and the last are some tiny bristles, arranged in pairs. A worm moves by stretching its body forwards from the tail and then closing up its body towards the head, just like a spring, first long and thin, then short and fat. The bristles act like little legs, and prevent, first the back and then the front part of its body from slipping as the other part is stretched out or drawn up.

A worm has no lungs and breathes through its skin, which is moist and slimy. If the skin becomes too dry, it cannot breathe. Count the segments, beginning at the head. On the fourteenth ring are two small holes. These are the oviduct pores from which eggs will come. Compare these with the ovary of a flower. On the fifteenth segment are two larger holes from which a liquid will come to fertilize the eggs. This liquid acts in a similar way to the pollen from the stamens of a flower.

Perhaps we can find a worm with a swollen band round its middle. This band is called the saddle, and just before the eggs are ready a fluid oozes from it and dries into a kind of elastic band. The worm then begins to wriggle backwards out of this band. As the band passes over segment fifteen it receives some of the fertilizing fluid, and then the eggs from segment fourteen; when the worm has wriggled out of the elastic band, the latter closes up at the ends to form a small cocoon which protects the eggs as they await hatching.

Flowers usually make seed better



RINGS AND BRISTLES OF WORM, MAGNIFIED.

when the pollen comes to the seed-box from another plant. So with worms, it is better for the fertilizing fluid to come from another worm. Two worms may be found lying side by side, but head to tail, with the elastic band of each round the body of the other. Then as each wriggles clear the eggs of the one are fertilized by the fluid from the other.

A worm has neither eyes nor ears, but appears to have a skin sensitive to the slightest touch. Although it cannot see, it seems to be able to distinguish between light and darkness; worms kept in captivity usually seek out the darkest parts of their dwelling. It is also very sensitive to earth tremors.

The digestive system is very simple, just a tube or canal without any bends, the whole length of the body, joining mouth and vent. This can be seen if the worm is held up to the light. The food-pipe serves two purposes—the digestion of food (leaves, etc.), and for the passage of all soil removed during the making of a burrow. The worm digs by swallowing the soil and ejecting it from the vent, hence the curly worm-casts seen near a burrow. Also some food is absorbed from the organic matter in the soil during its passage through the food-pipe. A healthy worm does not as a rule entirely leave its burrow to collect food; with its tail anchored in the hole, it stretches out and collects its food. It is no unusual thing for a leaf to be found partially drawn into the mouth of a hole made by the worm. The leaf is always placed stalk end in the burrow, as though the worm has found that this is the easiest way to draw the leaf in.

Children should be encouraged to count the number of worm-casts found on a measured plot of ground. If the plot is swept clear and then the count made twenty-four hours afterwards, an estimate can be made of the amount of soil brought to the surface. One or two casts may be collected and weighed, and thus the total weight of soil raised in twenty-four hours found. If the weight of the worm-cast is given in round figures, children should be able to do the calculation for themselves.

Charles Darwin made many observations on the activities of earthworms, and deduced that an acre of agricultural soil contains about 50,000 worms, which bring to the surface ten tons of soil a year. Children may be told that earthworms help the farmer by tilling the ground, the worm-casts break down into fine rich soil, the many burrows allow air and water to enter, leaves and other dead matter are buried and help to make a fertile loam.

The foundations and tiled floors of many ancient Roman buildings are now found many feet under the surface. This is largely the result of the activities of earthworms.

Children's Activities

(1) New words learnt and old ones revised: segments, saddle, sensitive, tilling, burrow, worm-cast, loam, etc.

(2) Keep two pots of soil, one with worms in, one without. Water the soil regularly and make notes of any differences in the pots at the end of a fortnight.

(3) Make a list of all the useful things the earthworm does.

(4) Make a list of the chief enemies of the earthworm.

(5) If you can find a worm partly out of its burrow, stamp on the ground a few feet away and watch what the worm does.

III. Plant Life

The Soil

Required: Samples of soil, one from the top three or four inches after the turf has been removed, and another from the second spit, i.e. from a depth of one to two feet. If possible, the soil should not come from a cultivated garden but from a field or other land that has not been recently worked. Iron spoon or large crucible, bunsen burner, beakers or gas jars.

First bring out the fact that all our food, except fish, comes from the soil. Either we eat plant products or meat from animals which have fed on plants.

Now the examination of soil samples begins. The first sample is called *topsoil* and the second *subsoil.* Make a list of things noticed in a general examination of the topsoil sample. Roots of plants, partly decayed leaves, worms, centipedes, beetles, slugs, stones, etc. Most of these things are picked out and set aside. A little of the remaining topsoil is now put into an iron spoon or crucible and placed over the bunsen burner. The children note what happens. First steam comes off from the damp soil, then smoke and various smells are noticed. What do the smells remind us of? The burning of the garden rubbish-heap? Potato peelings thrown on the fire? Burning leather, bones, wool, feathers, meat? Whatever the answers, it appears that the smells remind children of the burning of things of animal or vegetable origin.

The heating is continued until there is no further smoke or smell. The residue is allowed to cool, then roughly broken up and shaken in a jar of water. Part settles out quickly and part does not, but leaves the water muddy. The muddy water is poured into another jar and more water added to the settled residue, which is again shaken. Any more muddy water formed is added to the second jar and the process continued until no more mud is formed. The soil has thus been divided into three parts. The part that burns away, the part that makes water muddy, and the part that settles out quickly in water.

Most children will now be ready to say that the part that makes water muddy is clay, and the part that settles out quickly is sand. They will be proved right when time has been given for the muddy water to deposit a residue. The water in each case can be decanted off and the residue roughly dried on blotting-paper. The slimy, slippery feel of the clay can then be noticed. In the other case, the sand grains will be seen, although probably mixed with small stones and gravel.

What is the part that burnt away? As it is no longer present for examination, children must be told that it is a substance formed from all the one-time life of the soil—leaves, roots, insects, etc. —which has undergone decay. This part is called *humus.*

The subsoil sample may be examined in the same way, and it will be found that there is very little that burns away. Subsoil therefore contains less humus than topsoil. Why? Would soil from a depth of six feet be likely to contain humus?

Plants do not grow well in sand or clay, or even a mixture of both, but they grow well in soil containing humus.

Humus, then, makes a soil fertile, and the good farmer or gardener sees to it

that his soil is always well supplied with it. In uncropped ground the plants live and die in the same place, and in decaying give back to the soil the food they have taken from it. But in farm or garden the plants are cropped and taken away, and so more humus must be supplied if the soil is to remain fertile. Hence the manure-spreading and the compost heap of the gardener.

A fertile soil, then, contains sand, clay, and humus. Compare again the virtues of a sandy soil and a clay soil. The sandy soil is light, warm, easy to dig, gives early crops but is liable to suffer from drought. A clay soil is heavy, cold, difficult to dig, less liable to suffer from drought, does not give such early crops. In some cases it may become waterlogged. In very dry weather it may become hard and crack.

The market gardener likes a sandy soil because the earlier in the season he can get his lettuces, etc., to market the better price he gets.

A further necessity in a good soil is chalk. Some soils contain chalk naturally, but to some it must be added. It is sufficient to say here that chalk helps the soil to give food to the plant. The distinction between chalk and lime should not be gone into here, but if necessary it can be stated that if lime is added to the soil it soon turns into chalk. Tests for chalk are better left out, but if the teacher wishes, a little soil may be put into a test-tube and moderately strong hydrochloric acid added. A brisk effervescence denotes a chalky soil. No effervescence means a deficiency of chalk.

Mention may be made of cases where ground has been levelled by taking away the topsoil. Will plants grow well in the subsoil?

At first crops will be poor, but in time humus will collect, the soil will be broken up by rain and frost and by the action of worms, and so become fertile.

How is soil formed? Draw on the board the diagram in Chapter VI, Vol. III, GEOGRAPHY. Explain the gradual break-up of rock by weathering action, rain, wind, frost, the sun's heat, and so on. The children will also learn something about this in their geography lessons, see Chapter VI, GEOGRAPHY. At first the newly formed soil is barren. Then seeds dropped by birds or blown by the wind begin to sprout, living creatures invade the soil and finally die and decay, and so humus is formed.

Children's Activities

(1) New words learnt: sediment, humus, topsoil, subsoil, compost, drought.

(2) Draw a picture of the face of a quarry to show how rock gradually breaks down into soil. The diagram in Chapter VI, Volume III, GEOGRAPHY, will help.

(3) Make a list of as many things as possible that decay and form humus.

(4) A certain gardener always collected dead leaves, weeds, and other garden refuse into a heap and burnt it. He then spread the ashes on his garden. His neighbour made a similar heap, but waited for it to decay, and then dug it into the soil. Who was right?

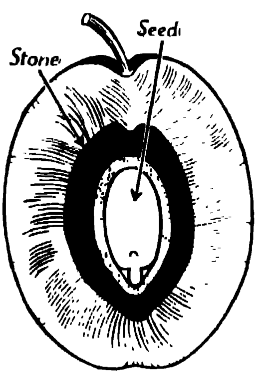
FRUITS (Plate XIV)

Required: Specimens of various fruits from the greengrocer's shop, if in season; also nuts, rose hips, peas and beans in pod. Fruit-tree blossoms, if available. Any lack of specimens may be made good by pictures or drawings. Cuttings from coloured advertisements

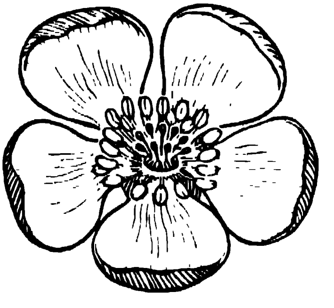
of jam manufacturers, or pictures from gardening periodicals or catalogues of seed merchants, should provide what is necessary.

What does the greengrocer sell? Fruit and vegetables. Make lists of some of the things seen in the shop. Which are fruits and which vegetables? In which list do we put rhubarb, tomatoes, peas, and beans? We usually give the name vegetable to something that comes from a plant, requires cooking, and is eaten with the meat course. But perhaps some of these things are really fruits. Consider some well-known fruits. Apples and pears have pips, plums have stones, strawberries and raspberries have pips or seeds. What will probably happen if these pips or stones or seeds are put in the ground? From the obvious answer we deduce that all these fruits contain seeds, but also contain some other part that we like to eat.

Examine a ripe plum. There is a skin, then a soft juicy part, then the stone. Is the stone the seed? Use a pair of nutcrackers to break the stone. Inside we find a kernel or seed. The stone is the hard case that protects the seed. How did the seed get inside the stone?



SECTION OF PLUM.

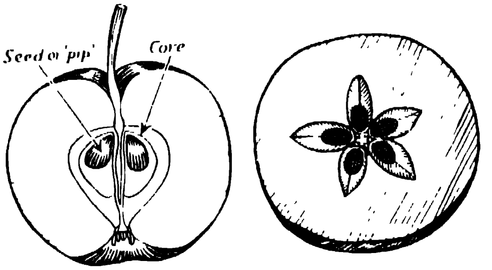


FLOWER OF PLUM.

Examine the blossom on a plum tree or in a picture. Note that it has only one seed-box. (If it is possible to show a series of specimens in different stages from blossom to young fruit, the next part of the lesson is made easier.) As the flower fades, the seed-box grows and swells out, becoming soft and juicy on the outside, but with a hard case forming inside round the seed. *Hence the plum is the ripened seed-box with the seed inside.*

Next consider an apple (or pear). Cut this across. Note the core, consisting of five small seed-boxes. Examine an apple blossom; the seed-boxes are difficult to see, being deep down in the swollen part of the stem below the calyx. But they are five in number, as in the fruit. When the apple flower fades, the swollen part of the stem swells still further and becomes fleshy. This is the apple, which is really a swollen receptacle (or stalk top) containing the seed-boxes.

To prove that an apple is really a swollen stalk top, look for an apple with part of the calyx attached. Note that this is above the apple, on the side farthest from the rest of the stalk. Look for the calyx attached to a plum. This will be on the stalk side of the plum, because the plum has the seed-box above the stalk.



APPLES CUT FROM TOP TO BOTTOM AND ACROSS.

Examine a rose hip; note that it has the same build as the apple.

Next take the blackberry or raspberry. Note that the eatable part of the fruit can be pulled away, leaving a small whitish hump behind. An examination of the flower shows that the seed-boxes grow on the outside of this hump (botanically, receptacle or end of the flower stalk). As the fruit ripens, the seed-boxes become soft and juicy.

An examination of the strawberry shows that the seed-boxes are all hard and on the outside of the fleshy part. This fleshy part is the hump (receptacle) that has grown soft and juicy as the fruit ripened.

All the fruits so far mentioned come from plants which belong to the same family as the rose. If the flowers are compared with the wild rose, the resemblance is evident.

Crack a hazel nut. Note that, like the plum stone, it has a kernel or seed inside. The nut resembles the plum, except that the outside of the seed-box has not become soft. Instead of this, the whole of the seed-box has become hard.

Examine a pea or bean flower. Note the little seed-box, shaped something like a pea pod. This seed-box eventually grows into a pod with the peas or seeds inside. The pea and bean are fruits when in pod.

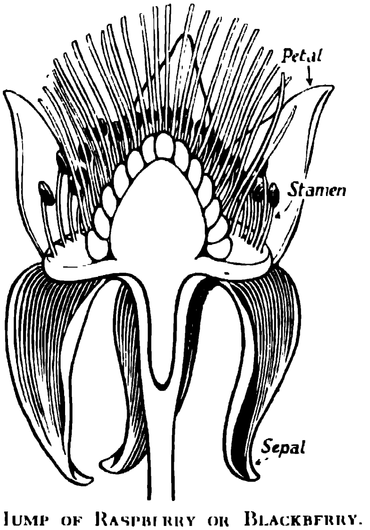
The vegetable marrow is a fruit. The resemblance of the marrow to the seed-box on the female plant is striking.

Other fruits may be examined, and children can try to decide by inspection which is the seed-box, and in some cases by looking for the calyx they can decide if the seed-box grew above the stem like the plum or deep down like the apple. They will have no difficulty in deciding that a tomato is a fruit.

A poppy head may be examined as an example of a fruit, also the long fruit of the wallflower, which opens when ripe, revealing the seeds on the central member.

Now they are ready to learn that a *fruit is a ripened seed-box containing the seeds*. This is the botanical definition, but in many cases some other part of the flower is attached, as in the apple, strawberry, etc.

Now consider how the seed from the fruit gets into the ground to grow into new plants. Birds and animals may eat the fruit and spit out the seed, or the seed may be swallowed and pass uninjured through the alimentary tract.



HUMP OF RASPBERRY OR BLACKBERRY.

Apples, pears, nuts, tomatoes, etc., may fall to the ground and decay, leaving the seed behind. Sometimes the fruit splits open when still on the plant and the seeds are scattered or borne along by the wind. The poppy and wallflower are examples of such.

Children may be asked if it is an advantage to the plant to have its seeds spread over a distance. What would be likely to happen to a young apple tree that grew from a seed just under the parent plant? Would it not die from lack of rain and sunlight?

Collections of fruits can be made, and children can try to decide which depend on wind dispersal (light seeds or the fluffy fruits of the dandelion or old man's beard, for example), which depend on birds (bright red berries), and so on. Fruits of the burr variety may be mentioned. These become entangled in the coats of animals and may be carried great distances.

Children's Activities

(1) Which of the following are fruits: acorn, rhubarb, lettuce, cauliflower, potato, carrot, tomato?

(2) Try to think of four plants which depend chiefly on birds for seed dispersal, four which depend on wind, four which depend on animals, and four which depend on the bursting of the fruit.

(3) Examine as many wild flowers as possible; make a drawing of each seed-box if you can. Then later, when the flower has faded, collect the fruit and compare its appearance with the seed-box in the flower.

(4) Make a collection of dried fruits and fix these in a book, writing the name below each fruit.

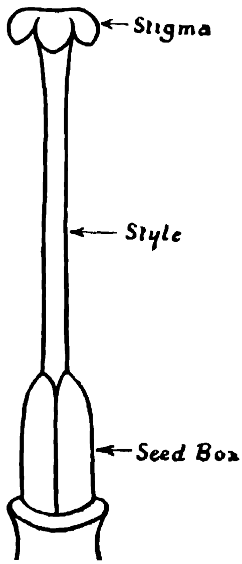
(5) Make a list of fruits of the Rose family. (See Volume III, GEOGRAPHY, Chapter VIII, for more about fruits and vegetables.)

FERTILIZATION

Required: Portfolio diagram of section of fuchsia (Plate IX). Many flowers as specimens, e.g. meadow sage, short- and long-styled primrose, cucumber, or marrow flowers, etc.

This lesson may be called "How the insects help the flowers."

Having already found out something about fruits and seeds, we must now try to find out how seeds are formed. Recapitulate earlier lessons about the parts of a flower. With actual flowers as specimens or from pictures or drawings, the children renew their acquaintance with the *pistil*, consisting of stigma at the top, then the style supporting the stigma, and at the bottom the seed-box or ovary. It is already known that before the seed can form in the seed-box a grain of pollen from the flower, or from another flower of the same kind, must fall on the stigma. Unless both pollen and stigma are ripe, no seed will form, but if a ripe pollen grain falls on a ripe stigma, the pollen grain slowly swells. After a time a slender tube grows from it. This pushes its way through the stigma, down the style, and into the ovary. In the ovary are one or more small whitish grains called ovules. When the tube sent down by the pollen (called the pollen tube) reaches the ovule, a kind of juice passes down this tube from the pollen, and this makes the ovule become a seed. This may take anything from a few hours to several days. One to three days for the crocus, more than five days for some lilies, and perhaps months for certain orchids.



PISTIL OF LILY.

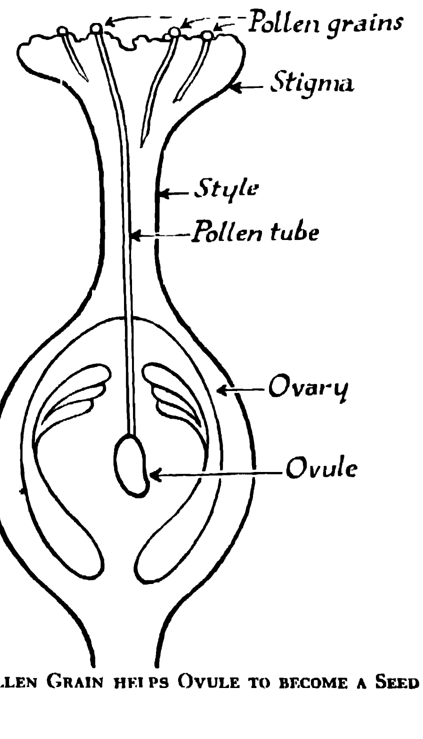
So without the pollen there will be no seed. Also, if the pollen comes, not from the same flower, but from another flower of the same kind, better seed is formed, which is likely to grow into a more vigorous plant.

Nature usually arranges matters so that there is more chance of the pollen coming to the stigma from another plant instead of from the same one. Perhaps the wind blows the pollen from one plant to another, but plants cannot always depend on having a wind just when pollen and stigma are ripe. There is more certainty when insects act as pollen carriers.

Why do insects come to the flowers? Many flowers have nectar which insects like. Some flowers attract the insects by their striking colours, and some by their perfume. When an insect visits a flower, it usually gets some pollen on its body. Then when it visits the next flower some of this pollen from its body comes off on to the stigma. This is just what the flower wants, so in this way the insect acts as a messenger and pollen-carrier for the flowers. We must not think that the insect does this on purpose. This is just one of the beautiful arrangements of Nature. The insect gets what it wants from the flower, and at the same time the flower gets the help it requires from the insect.

If children are encouraged to watch a single bee or other insect at work, they will see that it does not go from one kind of flower to another, but always, on the same journey, to flowers of the same kind. Today it may be buttercups, tomorrow perhaps primroses.

Children should examine as many flowers as possible in order to confirm that most of them are so constructed that the last things likely to be touched by an insect leaving a flower are the stamens, and the first thing likely to be touched on entering a flower is the



POLLEN GRAIN HELPS OVULE TO BECOME A SEED

stigma. Thus pollen from the stamens of one flower goes to the stigma of the next flower.

If things happened the other way round, the insect would merely transfer pollen from the stamens to the stigma of the same flower, and this would not be so good for seed-making. Examine various flowers to find out how their construction tends to prevent self-pollination, for example, sage—*Salvia officinalis* (use meadow sage or garden sage). Here the petals are united to form a narrow tube at the bottom of which is the nectar. Part of the corolla (ring of petals) is shaped like a hood, and the style reaches up into this hood so that the stigma is protected from rain. Another part of the corolla forms a platform or landing-stage for the insect. The stamens, two in number, have a crosspiece on the top, balanced like a see-saw with one end heavier than the other, so that the see-saw stands more or less straight up. The anther, or pollen sac, is on the top end.

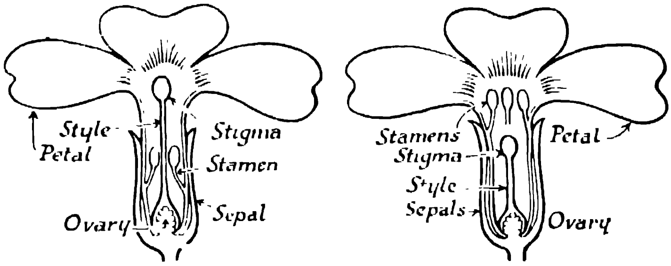
When the stigma is ripe, it bends over until it is so near the alighting platform that a bee visiting the flower is bound to be touched by it. Thus some pollen from the bee's back is transferred to the stigma. Next, as the bee enters the tube to get at the nectar, she pushes the lower end of the see-saw, making the top end swing down and sprinkle her back with pollen, which is then carried to the next flower.

A pansy examined with the help of a glass will show how the stigma must first be touched by a bee's trunk as it is pushed down towards the deep-seated nectar in the conical spur of the flower. The trunk next comes in contact with the stamens below the stigma. Pollen is thus deposited on the trunk. As the trunk is withdrawn, a small hinged flap closes over the stigma and prevents it from receiving the pollen from its own stamens. This flower can as a rule be explained satisfactorily only to very keen and intelligent children. In most cases it is better left out.

FLOWER OF THE SAGE.

The primrose is worthy of consideration. The flowers are of two kinds, pin-eyed or long-styled, and thrum-eyed or short-styled. Children can easily pick out the two kinds. In the first kind a little knob (the stigma) is seen in the centre of the flower when looking down into it. In the second kind no little knob is seen, but a rosette of yellow anthers is visible. The stigma, on account of the short style, is well down in the flower below the stamens. Pollen from the stort-styled flowers gives better results on stigmas of the long-styled flowers, and vice versa. The construction of the flowers ensures the cross-pollination.

A bee alighting on a primrose flower thrusts her head as far down into the flower as possible, but to get the nectar at the bottom of the tubular base she must use her long proboscis. Thus, if



PIN-EYED AND THRUM-EYED FLOWERS OF PRIMROSE.

the flower is long-styled, her head touches the stigma and her proboscis brushes the stamens and collects pollen. Then when she visits a short-styled flower her head receives pollen from the highly-placed stamens while her proboscis touches the lower-placed stigma and deposits pollen thereon. Thus the head of the bee carries pollen from a short- to a long-styled flower, and her proboscis carries pollen from the long-styled to the short-styled primrose.

Or put in another way, the head carries pollen from high stamens to high stigma, and the tongue from low stamens to low stigma. Reference may be made to unisexual flowers. Children have already heard about the marrow plant, which has some flowers with seed-box and stigma only, and others with stamens but no stigma. Other examples are the cucumber and the various catkin-bearing trees.

It may be mentioned that as cucumbers are usually grown in frames or greenhouses, the gardener must open the lights from time to time to allow bees or other insects to enter, otherwise pollen is not likely to be carried from one flower to another. Sometimes a skilful gardener pollinates plants in a greenhouse without trusting to insects. At the right time, he takes a little ripe pollen from a ripe anther with the aid of a camel-hair brush or feather and transfers this to the ripe stigma of another plant.

Children's Activities

(1) New words learnt, or old ones relearnt: pistil, stigma, style, ovary, ovule, stamen, anther, corolla, fertilization, pollen, nectar, proboscis, etc.

(2) Examine as many flowers as possible, and then draw pictures of the different kinds of stamens, showing how the anthers are set on the top.

(3) Draw a picture of the pistil of a flower and put in the name of the parts.

(4) Some flowers, like the pansy, have lines on certain petals which are supposed to guide the insects to the nectar. See if you can find these lines in other flowers.

(5) Make a drawing of the pistil of a lily, name the three parts of the pistil, and write what you know about them.

PLANT FOOD FROM THE SOIL.

Required: Small potted plant, say geranium or hydrangea, secateurs, bucket of water, glass and rubber tubing, large flask or glass bottle, Plasticine, small uprooted plants.

All living things must have food. Plants must feed if they are to live. Animals can roam about in search of food. Plants cannot do this. They must use their roots to get food from the soil, and their leaves to get food from the air. We can eat meat and potatoes, but a plant has no mouth and no teeth with which to chew. A plant cannot take solid food, it must live on slops.

Consider the three main parts of a plant: root, stem, and leaves. The roots

spread into the soil in search of food, and also keep the plant firmly fixed in the ground. The stem supports the leaves above ground, so that they can drink in air and sunshine.

How do the roots obtain food for the plant? Examine the roots of a small plant—lettuce, marigold, daisy, etc., carefully dug up and freed from soil. Note how they branch and branch again, the final branches being of hair-like fineness known as root-hairs. These root-hairs have very thin walls through which water can soak and so get inside the roots. The water in the soil contains substances derived from the soil which the plant requires as food. The soil-water soaks into the root-hairs, carrying with it the food substances, finds its way along the roots, up the stem and into all parts of the plant, including the leaves. The roots help in pushing the water up the stem towards the leaves. If the stem of the plant were made of glass, perhaps we could watch the water going up. Maybe we can arrange this.

The experiment works best in springtime, for then the roots are most active.

A small plant in a pot is taken—a hydrangea gives the best result, but any plant with large non-shiny leaves will serve. The pot is sunk in a bucket of water and the stem cut across a few inches above the soil. The cut must be made under water. A piece of glass tube about twenty-four inches long is attached to the stem rising from the soil, by means of a short length of rubber tubing. This must be done under water and the rubber wired to the stem to ensure a good fit. A stick is pushed into the soil and the glass tube tied to it for support. The pot is now lifted from the water, and we have what is in effect a plant with a glass stem, but neither leaves nor branches.

Note the water-level in the glass tube. The plant is placed in a light, airy place, and the water-level marked from time to time. Half an hour will show a distinct rise in the water-level, and the top of the tube may be reached in the course of a day. The soil should be kept moist. The term "root-pressure" may now be introduced.

If water is continually entering a plant, how does it get out? What happens to it? Another experiment will show us.

A small leafy twig on a growing plant or on an outdoor tree is pushed into a flask or bottle without detaching the twig from the plant. The bottle-neck is then closed round the stem of the twig with Plasticine, the bottle supported, and events awaited. If the day is sunny, the bottle will soon become

CUTTING STEM UNDER WATER

misty inside, and by the end of the day a distinct amount of water will have collected in the bottle.

Where has this water come from? It can only have come from the leaves. Now we know what happens to the water that the roots take from the soil. It is given off by the leaves to the atmosphere. Note that only water is given off; the food substance the water contained is retained by the plant for body building.

If a small twig gives up all this water, how much must come from the leaves of a large tree? A fully-grown tree in summer may give off one hundred gallons or more.

Trees tend to make the soil dry and the air moist. Tree roots usually spread at least as far as the branches, and the root-hairs are mostly at the root tips and so likely to be in ground kept moist by the drips from the tree when it rains. Close to the trunk it is likely to be dry, and root-hairs would collect little water. The sweating, or giving off moisture, by the leaves is spoken of as *transpiration*.

Children might be asked to make notes of the kinds of trees in their neighbourhood. It may then be possible to deduce that the trees and plants which are common in dry places are usually those with small, hard, and shiny leaves. These would not give off so much water as the larger and more porous leaves, so their demands on water from the soil would be less. Examples are the pine trees growing in sandy soil and the spiky grass of the sand dunes.

If plants continually take food from the soil, there will come a time when the soil has no more food left to give, unless the food store is replenished. In uncultivated land the plants live and die in the same place, and so the food taken from the soil is returned to it.

When land is cropped, however, the plants—wheat, barley, potatoes, etc.—are taken away and made into food for us. Such land is steadily losing its food store and will at last become barren. This has actually happened in some of the wheatlands of Canada, and whole tracts have to be left fallow until new food matter forms as a result of weathering and other agencies.

Generally, however, the food store is replaced by manuring. Farmyard manure contains the very things required by the plant as food. If farmyard manure is short, artificial manure is used instead.

The question of food from the air should be tactfully avoided by the teacher, as carbon assimilation by plants is a subject better left until the children are older.

Children's Activities

(1) New words learnt: root-pressure, root-hairs, transpiration, fallow, etc.

(2) Try the transpiration experiment with two bottles on the same tree. Shade one bottle from the sunlight and see if it makes any difference.

(3) A book left on the lawn for a time usually becomes damp underneath, even although the lawn appears to be dry. Do you know why this is?

(4) Would you like to have a large pear in a bottle? This is what you can do if you have a pear tree in the garden. In early summer, when the blossom has fallen, push the stalk carrying a young pear into a bottle and tie the bottle to the tree. Do not stuff up the neck of the bottle. The pear will

continue to grow until it fills the bottle. When it is big and ripe, you can break the stalk, and then nobody will be able to get the pear out of the bottle. (The same may be done with an apple, which will grow long and thin to fit the bottle.)

The Food Store in the Plant

Required: Seeds of various kinds, including wheat, barley, oats, potatoes, carrots, turnips, primrose—all if possible with root and leaves. Crocus or other corm, onion, also hyacinth growing in water.

Introduce the lesson by a talk about the wisdom of saving for a rainy day. Mention types of food store—the pantry or larder at home, the honey in the beehive, the dog which buries its bone, the squirrel with its nut store, etc. Why should plants want to store food? The aim of each plant is to reproduce its kind. Some live for a season, produce seed, and die. These are called *annuals*. Their seed contains the baby plant for next year's growth. Examples are peas, beans, cereals, marigolds, nasturtiums, cornflowers.

Others take two seasons to complete their life. The first season they grow from seed, but produce no flowers. During the winter they rest, and the following season produce flowers and seeds before they fade away. These are *biennials*; examples are Canterbury bell, sweet william, aster, wallflower, carrot, turnip, cabbage.

A third class live on for year after year. These we call *perennials*. Such are trees, fruit bushes, buttercups, and daisies.

Seeds contain a baby plant and a store of food. The food is to nourish the young plant which grows from the seed until it has pushed its head above the ground, grown leaves, and so become ready to support itself.

Most annuals and biennials produce quantities of seed, and making a food store for each of these is a formidable task. The parent plant exhausts itself in providing the food stores for its young. When it has made all its seed, it withers away. It could live for many years if it made no seed. We can prove this by cutting off all flower-buds from an annual—say mignonette—before they have time to open. No seed can then be made, and the plant remains strong for years.

Biennials make a store of food during the first season, ready to give to the seed at the end of the second year. Some biennials make this store in their roots, which thus become swollen; carrots, turnips, parsnips, and radishes are like this. We dig up the swollen roots and eat them as vegetables. Yet if we left them in the ground through the winter they would flower and seed in the following year, and the roots would shrivel as the food store passed to the seeds.

A cabbage is a huge bud, and the food is stored first in the leaves. If the cabbage were allowed to flower, this store would pass to the seeds. More often it is the underground part of a plant (but not always the root) where the food store is found.

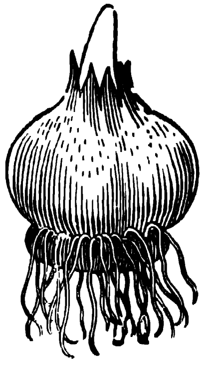
Some plants have a creeping underground stem called a *rhizome* in which food is stored. Examples are the primrose, Solomon's seal, and buttercup. Although roots may grow from this stem, we know it is not a root itself, because it has buds, from which new shoots may grow. Incidentally, arrowroot is obtained from the rhizome of a

plant called the maranta, which grows in tropical countries.

Another underground stem used as a food store is the *tuber*, of which the best example is the potato. The dahlia also has tubers. The potato tuber is a part of an underground stem that has swollen out into a food store. Dig up a potato plant and notice that it has roots with root-hairs, but the actual potato, along with the rest of the stem, has no root-hairs. We can think of this as an underground branch or stem swollen out at the end into the potato. The tuber itself has buds, or eyes, from which new plants can grow. A small potato, or even a part of a potato, planted in the spring, will give rise to a new plant, the food store in the tuber nourishing the young plant until it can take care of itself.

A *corm* is a special kind of tuber, caused by a swelling at the base of the flowering stem, as in the crocus and gladiolus. When the crocus has flowered, the stem dies down, and another stem, at first nourished from the corm, grows up in the following year.

Show a hyacinth growing from a bulb in water. Where does the food come from? The roots can be seen dip-



CORM.

ping into the water, but there is no soil to provide food. Here the food comes from the store that was made in the *bulb* by last year's plant. The bulb is really a large bud with the food stored in the swollen bud scales. Other bulbs are tulip, daffodil, onion, shallot.

To sum up, plants may store food in seeds, leaves of buds, bulbs, rhizomes, tubers, corms, and roots. Carrot tops may be placed in water and will grow new plants which will live so long as the food store lasts.

Children's Activities

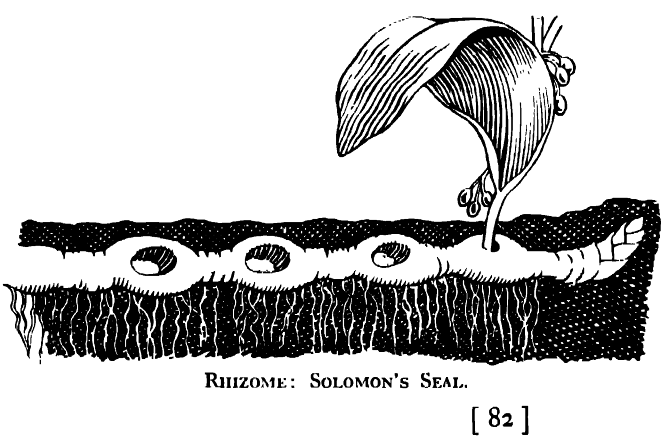
(1) New words learnt: annual, biennial, perennial, rhizome, tuber, corm, bulb.

(2) Examine an ear of wheat. Pull it to pieces carefully, and see if you can find the baby plant and the food store.

(3) Mention six annuals, six biennials, and six perennials.

(4) Some weeds in a garden are annuals, others are perennials. Which do you think are easiest to get rid of, and why?

(5) Find out from the History Section how the potato came to this coun-



RHIZOME: SOLOMON'S SEAL.

try, and who introduced it. For the story of the potato and its travels, see *What the World Eats* (Evans).

The Greengrocer's Shop, the Garden, and the Allotment

Required: Flowers of turnip plant, cabbage, and wallflower. Grubs and pupæ of daddy-long-legs, wireworms, etc., magnifying-glasses.

This lesson will be helped if visits are made to the school garden or an allotment. A list of things commonly seen in the greengrocer's shop may be made and a discussion started on which parts of the plants are eaten in each case. There should be no difficulty in coming to a decision that in general the part we eat is the food store of the plant.

Examine a turnip flower with the help of a magnifying-glass. Note the four petals arranged in the form of a cross: the resemblance to a cross is not usually very evident to children, but if a plan of the flower is drawn on the blackboard, lines joining opposite petals will then be seen to be in the form of a cross (hence the order Cruciferæ, to which the turnip belongs). The sepals alternate with the petals and fit closely round the base. There are six stamens, two short and four long, although in cultivated plants of this order there is a tendency for all the stamens to become the same length. The seed-box is long and upright, with two stigmas.

The same arrangement can be seen in the wallflower, which, being larger, is easier to examine; also in the cabbage flower.

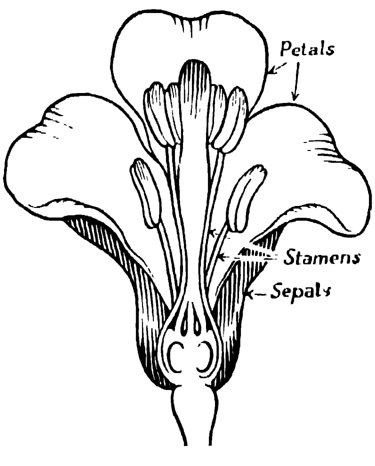
It will probably not be possible to examine many types of this order, but it may be stated that many of the plants we eat as vegetables belong to the order of cross-shaped plants. In addition to the turnip and cabbage, we have seakale, radish, cress, horseradish, cauliflower, broccoli, brussels sprouts, and savoy, the last four being really varieties of the cabbage.

All cross-bearing plants are non-poisonous, although all may not be good to eat.

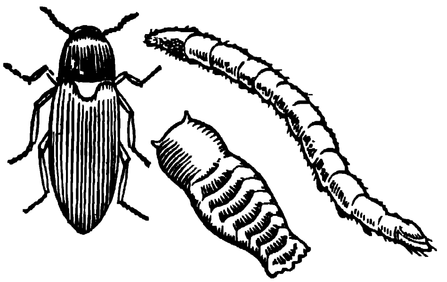
All our vegetable plants are cultivated plants; that is to say, they are the descendants of plants that in the wild state were not so useful as vegetables. Gardeners, growing these plants in good soil and giving them careful attention, have succeeded in altering the shape and producing new varieties that are more suitable as food.

For example, all the vegetables of the cabbage class are derived from a wild cabbage that still may be found near the coast in south-west England, a plant with broad, smooth leaves and yellow, cross-shaped flowers.

In the case of the cultivated cabbage, savoy, and brussels sprout, we eat the leaf buds, but in the cauliflower it is the flower buds we eat. We eat the swollen roots of the carrot, turnip, and



Turnip Flower



Click Beetle and Wireworm.

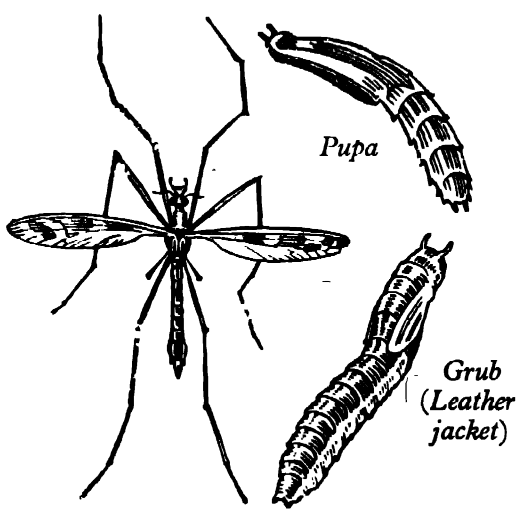
parsnip, the bulb of the leek, shallot, and onion, and the seeds of peas and beans; also the tuber of the potato. In fact, our vegetable food is usually the food store the plants have made for themselves.

Cultivated vegetables, then, are plants which have been derived from the wild plants by the skill and attention of many generations of gardeners. Generally speaking, the food-store part of the cultivated plant is more fully developed than in the wild plant. Wild potato tubers are generally small, but the tubers of cultivated potatoes may grow to a great size. The aim of the gardener is to produce as much food as possible from a given plot of ground. More food can be obtained from an acre of potatoes than from the same-sized plot of any other vegetable. The cultivated cabbage, instead of having its leaves straggling all along the stem, has them all collected together in a large compact bud, or in the case of the brussels sprouts, in a series of smaller buds.

What does the gardener do in order to produce good vegetables? He digs the ground well to admit air and moisture, clears away all weeds which might take food from the soil or choke the vegetable plants, and supplies the soil with manure. Then he selects good seed and sows it at the right time, afterwards giving any necessary attention to the soil and the growing plants. He must take care that the food store is not attacked or eaten by any of the creatures which live in the soil, for if we like vegetables, so also do grubs, caterpillars, wireworms, snails, and slugs.

Some caterpillars eat the leaves of the young cabbage and some eat the roots of other plants. The wireworm is one of the enemies of the gardener. Examine a wireworm and notice its yellow colour, its tough skin, and its three pairs of legs. It eats its way into potatoes and roots of other plants and does much damage. Sometimes the gardener puts pieces of potato and carrot in the ground, then lifts them up from time to time in order to destroy any wireworms that have eaten their way in. The piece of potato or carrot is used as a trap for the wireworm.

The wireworm comes from an egg laid by an insect called the click beetle, or skipjack. If you turn a click beetle on its back, it bends itself nearly



Daddy-long-legs.

double, then straightens out with a little click, thus throwing itself into the air so that it can fall on its feet again. A wireworm may live for several years in the soil before becoming a pupa, and during all this time it is doing damage to roots of plants.

Another pest is the daddy-long-legs or crane fly, which drops her eggs on the soil. The eggs hatch into large, tough-skinned grubs called leather-jackets, which feed on the roots and stems of plants, especially potatoes and lettuces. When fully grown, the grub turns into a pupa which sticks straight up out of the soil. This can be a nuisance on lawns and bowling-greens.

The gardener destroys as many of these pests as he can find. Digging the soil well in winter helps to get rid of many pests, especially those in the pupa stage, which are either buried so deeply that they perish or are brought to the surface and may be snapped up by birds.

Children's Activities

(1) Make a list of as many vegetable plants as you can, and put opposite each the part of the plant we eat.

(2) Which birds are friends of the gardener, and which are not liked in the garden?

(3) Make lists of any creatures you know which eat the seeds of plants, those which eat the roots, and those which eat the leaves.

(4) Plan a Vegetable Exhibition—have real vegetables and pictures. Arrange the vegetables in families—the cabbage family, etc. See *English of Your Daily Life*, Book IV (Longmans), for the story of a Vegetable Exhibition.

IV. Related Science

This part of the course now begins to play a more important part in the syllabus as children begin to realize the universal aspects of Nature's manifestations. Without some knowledge of the more simple facts of physical science and their relation to everyday life, future progress in the study of Nature will tend to become narrow and unsatisfying.

A study of common physical phenomena helps to a fuller understanding of the life-processes in the plant or animal, and the effect on these of changing conditions of soil, weather, and environment.

THE MOON

A general talk about the moon will be the best way of giving children an idea of what it is. Its size and distance from the earth may be mentioned, for although they will not be able to visualize either size or distance, yet children appear to revel in large numbers and distances. The diameter of the moon is just more than 2,000 miles—about one-quarter the diameter of the earth. Its distance from the earth is 240,000 miles, a distance equal to about ten times the circumference of the earth, or one four-hundredth of the distance from the earth to the sun. The earth is about fifty times as big as the moon, but the moon being less dense, it would take more than eighty moons to balance the weight of the earth.

The force of gravity on the moon's surface is only one-sixth that on the earth. Children will not understand this, and no attempt should be made to explain it to them, but they will be interested to be told that a man from the earth could, if he were on the

moon, lift six times as heavy a weight or jump over a two-storied house. The markings on the moon we know to be mountains, and it is thought that they are extinct volcanoes.

To see the details on the moon we must look through a telescope. Here a digression may be made for a talk about telescopes, what they do, not how they work. Opera-glasses, binoculars, and nautical telescopes could be mentioned, leading to the statement that specially large telescopes are needed to observe the sun, moon, and stars. These telescopes are too big to be carried about, and so are housed in special buildings with glass roofs. These are called *observatories*. The men who use them are called *astronomers*. *Note.*—The astronomer does not look at the sky through the glass roof, but through an opening made in it by sliding a part away. Thus the glass roof is not an essential part of an observatory. Where possible an observatory is built on an elevation in a place where the air may usually be expected to be clear. When Greenwich Observatory was built, the air there was probably clearer than it is today. What we know about the moon and the stars we owe to the astronomers who night after night watch through their telescopes.

The moon is a dead world, with no light or heat of her own, no atmosphere, no animals, no plants. We could not live on the moon. The moon has no light of her own. Compare an aeroplane in the sky at night. It is invisible because it sends out no light. But if a searchlight is directed on to it, the aeroplane shines with a silvery light. So with the moon; only when the sun shines on it do we get the moonlight, reflected light from the sun.

Consider the moon seen by day; it looks no brighter than the clouds in the sky. Both reflect the sun's rays, and both have an equal brightness. The sun can only light up one-half of the moon's surface. Sometimes we see the whole of the lighted surface, and we call this full moon. At other times we see only part of the illuminated disc, and we use the names quarter, crescent, etc.

Phases of the moon have already been dealt with, but it will be well to go over these again. Dates of the phases can be obtained from the average pocket diary, and the children can be advised what to watch for. Note that the date given as New Moon is that on which no part of the illuminated disc is visible; a faint crescent, however, can usually be seen on the following evening.

Children may say that they can sometimes see the part of the moon that is not shining. This faint outline is seen because of earth-shine, light reflected from earth to moon and back again to earth. The outline of the rest of the moon, seen when only a thin crescent is illuminated, is sometimes spoken of as " the old moon in the new moon's arms." There is a belief in some places that this is a sign of bad weather, but there is no evidence that the moon in any of its appearances or changes has any effect on the weather.

As there is a change of the moon's phase once a week, and as the weather in this country usually changes at least as often, it is not difficult to see how a believer in this fallacy finds a fancied support for his belief. The period between one new moon and the next is about 29½ days, and is called a lunar

month. Our calender months are arbitrary divisions of the year, and have no direct connection with the moon's changes. We see the phases because the moon revolves round the earth. We say it is a *satellite* of the earth, just as the earth is a satellite of the sun.

We see the same side of the moon always, never the other side. This is because the moon revolves on its axis in the same time as it revolves round the earth. This will not be clear to children at first, but if an object to represent the earth is put in the centre of the room and a child is told to move in a circle round this object, keeping his face towards it all the time, it will be evident that the child, in completing his circle, has also revolved on his axis. The smaller the circle, the more easy will it be for children to follow this.

If another child takes the place of the central object, he can bear witness that all the time only the face of the revolving child was visible to him. The children will then realize that we do not know what the other side of the moon looks like.

What would the earth look like from the moon? Children may like to speculate on this, and although mistaken ideas need not unduly worry the teacher, it will probably not be difficult to bring out the truth that the earth would appear to be shining, just as the moon appears to us.

An idea of the vast and relative distances of the moon and sun can be given by saying that, travelling at the speed of an express train (60 m.p.h.), it would take about five months to reach the moon, but nearly one hundred and eighty years to get to the sun.

Stars and Planets

(See Plates X and XV)

Some of the well-marked stars and constellations should be pointed out on the star map and named. The characters in Greek mythology whose names the constellations bear may be talked about, and, according to the desire of the teacher, some of the mythical tales may be related. There is Cassiopeia, the mother of Andromeda; Perseus, who rode on the winged horse Pegasus to rescue Andromeda from the sea monster; and Orion, the mighty hunter. Kingsley's *Heroes* will furnish material for the tales.

Orion is easy to find; the two top stars are supposed to be his shoulders, the two lower ones his feet, and the three in the middle his belt. The belt of Orion forms a good guide to the Dog Star, Sirius, a star of the first magnitude and the brightest in the northern heavens. The belt points downwards a little to the right of Sirius, which is roughly on a level with the feet of Orion.

Other constellations can be found from the Great Bear and the Pole Star. If the line of the pointers is continued past the Pole Star for about the same distance, it passes Cassiopeia, a group of five stars in the form of a W. The same line continued reaches the great square of Pegasus. Think of Pegasus as a square frying-pan with a long handle stretching away below Cassiopeia. The stars in the handle form the constellation of Andromeda and the three at the end Perseus.

It is useless to attempt to convey any idea to children of the immense distances of the fixed stars. All that can be said is that they are much farther away than the sun, and that they them-

selves are suns, some of them much bigger than our sun.

Have they any worlds spinning round them like our sun? We do not know, as they are too far away for us to see.

But our sun has several worlds revolving round it. These are called *planets*. The word "planet" means wanderer and was given to these stars by the early astronomers because they did not stay always in the same place in relation to the other stars, but varied their positions from night to night, and sometimes were not to be seen at all. We now know that this is because, like our world, they constantly revolve round the sun.

Their names, in order of nearness to the sun, are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

Sometimes we see Venus in the western sky at night; being near the sun, it sets shortly after sunset. Mars, when visible, is recognizable by its ruddy hue. Jupiter and Saturn can be seen without a telescope, but children are not likely to find these two unaided.

Some of the planets have moons. Mars has two, Jupiter eight, and Saturn ten, in addition to the rings. The rings are presumably made up of innumerable small moons.

Some child is sure to ask if there are any people on the planets. The answer to be made to this is that we do not know, but we can say that there can be no life on any of the planets similar to life on the earth. Some of them are too hot and some too cold; some have atmospheres unlike our own.

All that need be said about the Milky Way is that it is made up of millions of stars so far away that individual stars cannot be seen by the naked eye.

Children's Activities

(1) New words learnt and old ones revised: observatory, astronomer, telescope, satellite, planet, fixed star, constellation, lunar month, phases of the moon, axis, etc.

(2) Draw the Great Bear, Orion, Cassiopeia. When you have put in the stars, see if you can draw pictures round them to fit in with the names.

(3) Make up a story about an imaginary man who went to the moon.

(4) Make a drawing of the sun and the planets travelling around it (Plate XV).

Time and Timekeepers

Required: Egg-boiler, picture of sundial, small candle or taper, simple pendulum, picture of Big Ben.

The question, "Who was late for school this morning, and why?" will serve as an introduction to the subject. "The clock had stopped, or was slow, or the alarm clock did not ring" may be among the answers.

What did people do before clocks were invented? The history of time measurement can be made interesting to children.

Probably early man noted only sunrise and sunset; he had no school to attend and no appointments to keep, and time mattered little to him. Later he would be able to judge the passage of time by noting the position of the sun in the sky. As the apparent journey of the sun is regular, he would learn to associate the time it took the sun to travel from, say, one mountain top to another with the time taken to make a certain journey or do a certain task. Later, no doubt, he watched the shadow of a post or rock and noticed

that it moved or lengthened with some sort of regularity.

At one time, in ancient Rome, only sunrise and sunset were officially noticed, and were announced by the blowing of a trumpet. Later the trumpet was also blown when the sun reached its highest point, thus marking noon or midday.

The post-shadow was the forerunner of the sundial. As man's knowledge grew, he found that the shadow of a rod sloping in a particular way gave better results than a vertical one. (It is better not to attempt to explain why and how a gnomon is used.)

Alfred the Great is said to have fitted candles with rings, so that they took an hour to burn from ring to ring. What the rings were made of we do not know, but we are told that the candles were shielded from draughts by being enclosed in horn lanterns.

Pictures of sundials, Alfred's candle clock, hour-glasses, and more about telling the time long ago will be found in Volume III, HISTORY.

Marks may be painted on a small candle such as is used on Christmas trees, or on a white taper, the teacher having previously found out by experiment where to place the marks, so that each division represents a fixed time—not necessarily an hour. The candle can then be left burning in the classroom. It should be hidden from the class by a screen, which may be removed from time to time for inspection. If left in full view, some children will rivet their attention on it and miss the rest of the lesson.

An egg-boiler may be exhibited as a pattern of the sand-glass or hour-glass. These usually ran for one hour and were used rather for timing a task, lecture, or speech, or the passing of an event than for telling the time of the day. The sand-glass was used in some churches to indicate the time of the sermon. The preacher turned over the glass before beginning his sermon and was presumably expected to finish by the time the sand ran out. The sand-glass is still to be seen in some old churches.

The early Egyptians used a perforated bowl with times marked inside. The bowl was floated on water, and as it slowly sank the inside-level of the water marked the time. In other cases the bowl was filled with water, which slowly leaked away. (See Volume III, HISTORY.)

For demonstration a burette may be marked with elastic bands, filled with coloured water, and allowed slowly to drip at the tap.

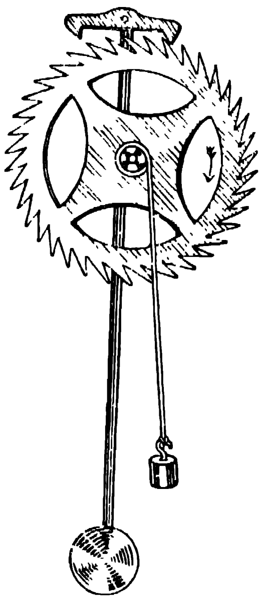
Until clocks became common and reliable, the hours of the day were not accurately known.

The first clocks, chiefly in church towers, worked by the uncoiling of a weighted rope wound round a drum. As the weight descended the drum slowly turned, its motion being retarded by a brake, and, being geared up to a large wheel carrying an hour hand, marked the passage of the hours. These clocks were not accurate, as the weight of the rope usually caused the clock to gain as the day progressed. The early clocks had no minute hand. The discovery of the pendulum made it possible to regulate clocks with precision.

The invention was due to Galileo, about whom we have already heard in connection with the motion of the earth round the sun. Sitting one day in the cathedral of Pisa, he noticed that the lamps, hanging from chains of the

same length, were swinging, some with long swings (great amplitude) and some with short swings. He was interested to observe that each lamp, whatever its swing, took the same time to make one to and fro swing. Galileo, of course, had no watch, but he had a steady pulse, and this he used to time the swings. He found that the time of swing never varied. This made him think, and on returning home he carried out experiments with strings of different lengths, each with a weight at the end. Here he discovered that a given length of cord took always the same time to make one swing, whatever the amplitude. He also found that the longer the cord the longer was the time of one swing.

Here the experiment may be made in class, the children counting ten swings of a long pendulum (a suspended string with a weight on the end) and the teacher noting the time. By varying the length of the pendulum the truth of the above may be shown, and by trial and error the length of the pendulum may be adjusted to beat seconds.



PENDULUM AND ESCAPEMENT.

It is not thought that Galileo actually made a pendulum clock, but we know that after his discovery clocks with pendulums began to be made and were found to keep good time.

A clock pendulum has a rod instead of a string, and at the top of the rod is fixed a kind of double hook. One of the cog-wheels of the clock is so fixed that first one and then the other side of the double hook swings in between two cogs of the wheel. Thus the wheel can only turn when the swing of the pendulum lifts the hook from the cogs. The other end of the hook falls on to the wheel as it is turning and gets a little kick from one of the teeth. This helps to keep the pendulum swinging. The arrangement is called an *escapement*. The speed of the wheel is governed by the time of swing of the pendulum, and as the cog-wheel is geared to the other moving parts, the clock keeps steady time. To make the clock go faster the weight on the end of the pendulum is raised, and vice versa.

If a pendulum and escapement from an old clock can be shown to children, they will more readily understand, otherwise the success of the explanation will depend to a large extent on the skill of the teacher in drawing a diagram on the blackboard. It must be made clear that a pendulum does not make a clock go, but only keeps it going at a regular speed.

Watches and some clocks have no pendulum, as a pendulum necessitates a fixed position for the timepiece.

In place of a pendulum there is a

balance-wheel, a small wheel which swings to and fro on a pivot and acts like a pendulum. Reference may be made to well-known or public clocks, also to Big Ben and Greenwich time, and to the time signals on the wireless. Big Ben is really the name of the large bell on which the hours are struck in the Westminster tower of the Houses of Parliament. The clock is regulated from a master clock at Greenwich, which in turn is controlled by regular observations of the sun.

The question of electric clocks is almost sure to crop up, but no attempt to explain their working should be made. Being connected to the electric mains, they depend on impulses from the power-station and are synchronized with a master clock at the station. Children will be satisfied if told that these clocks go by electricity and keep good time. A.M. and P.M. and the Continental 24-hour system may be explained if desired. (See Volume III, GEOGRAPHY, Chapter II.)

Children's Activities

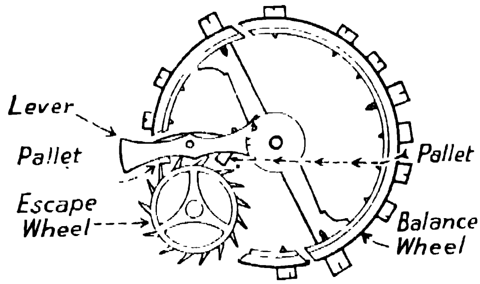
(1) New words learnt or revised: sundial, hour-glass, pendulum, escapement, balance-wheel, pivot, cog-wheel, etc.

(2) Mention some famous clocks you have seen or heard of, and say what you know about them.

(3) Make a pendulum, and by altering the length of the string find out how long it must be to swing once a second. For more experiments with a pendulum, see *Projects for the Junior School,* Book II (Harrap).

(4) What is Summer Time? Try to find out whose idea it was. Do you think it is good or bad for children?

(5) Tell or write down all you have learnt in the history lessons (see Volume



BALANCE WHEEL OF CLOCK

II) about telling the time through the ages, beginning with the shadow-stick.

(6) Find out about the clock used on board ship, the chronometer (see *Projects for the Junior School,* Book IV, Harrap). Interesting projects about telling the time will be found in *Projects for the Junior School,* Books I-IV (Harrap).

HEAT AND ITS EFFECTS

There is material here for several lessons; the notes below have been grouped under suitable headings and should be taken in this order. It is unwise to attempt a definition of heat at this stage.

Temperature

Required: Alcohol and mercury thermometers, clinical thermometers, three basins, hot and cold water.

Begin by asking if it is hot or cold today in the classroom; talk about the cup of tea that father says is cold and about the water drawn from the tap for drinking in summer that is said to be too warm. Show that we call things hot or cold according to what we compare them with, or what we think they ought to be.

Perform the experiment with three bowls of hot, tepid, and cold water. A girl puts one hand in the hot water and the other in the cold. One hand

says "hot" and the other "cold"; after a moment both hands are taken from the respective bowls and plunged into the tepid water. The hand coming from the hot water now says "cold" and that from the cold water "warm." Two different ideas about the same water. Evidently our sense of touch is not a reliable guide to hot and cold.

Show a thermometer—a glass tube with a bulb at the bottom; a coloured liquid (alcohol and a dye) or some quicksilver is in the bulb and part of the tube. The thermometer should have Fahrenheit markings. Children may know something about these, and also the markings for freezing- and boiling-point. Why is freezing-point 32°? Fahrenheit was a German glass-worker who later became a doctor. When he made his first thermometer he put the bulb in a mixture of crushed ice and salt, which he thought (erroneously) to be the coldest thing possible. He made a mark on his thermometer and called this 0°. Ice and salt give a lower temperature than freezing water.

If children are satisfied with this explanation, it is as well to leave it there, for the rest of the tale is slightly involved and somewhat obscure.

He appears to have next placed the bulb under the armpit of a young healthy farm labourer, knowing that the human body in health has a steady temperature. He called this mark 24°, but later found the degrees to be too large. So he divided each degree into four and renumbered. This gave body temperature as 96°. Then, when at a later date the temperature of boiling water was taken, it was found to be 212°.

Presumably the graduations on his early thermometer were not very accurate, for body temperature is now known to be 98·6° F.

Children will suggest various uses to which thermometers are put, and will no doubt mention the doctor's thermometer. Why is it put in the patient's mouth or under the armpit? The doctor takes the thermometer to the light in order to read it. What would happen to an ordinary thermometer in this case?

The clinical thermometer has a constriction in the stem which breaks the mercury thread as the liquid in the bulb contracts. Before using again, the broken thread must be shaken down. The engraved "½ min." or "1 min." on some clinical thermometers refers to the minimum time the instrument must be left in the mouth in order to acquire the correct temperature.

A temperature chart may be shown if desired, and a discussion started on temperatures in illness. The term "normal" in reference to temperatures should be explained.

Temperatures generally may be talked about; suitable classroom temperature 65°, 60° for practical work. What is the meaning of "80° in the shade," "12° of frost," etc.

Extreme temperatures may be: 130° in the shade at the Equator, 60° of frost at the North Pole, hot bath 105°.

If a Centigrade thermometer is shown, it is sufficient to state that freezing-point is 0° and boiling-point 100°. Conversion from one scale to the other should not be attempted, except by reference to a thermometer with both markings.

It may be mentioned that mercury thermometers are useless in very cold countries, as mercury freezes at about

$-40°$ (C. or F., this being the only temperature where both scales read the same). Alcohol has a much lower freezing-point, but boils at 78° C., so cannot be used in thermometers to measure high temperatures. Mercury boils at 350° C.

Children's Activities

(1) New words learnt: thermometer, temperature, Fahrenheit, Centigrade, degrees, clinical, normal temperature.

(2) Mention some things that we call cold which are hotter than other things we call warm.

(3) Write down each day at 9.30, or before school, the temperature of the classroom for a month. Notice how it varies. Make a Temperature Graph. (See Volume III, ARITHMETIC.)

How Heat Travels: (1) Conduction

Required: Rods of metal, glass, etc.; wooden and metal spoons; black and white painted board; pictures to show policemen, men of the Royal Navy, people in hot countries, with white hats or covers in summer.

Heat the poker in the fire (or a piece of metal in a bunsen), plunge it into a tin of cold water. Let children find out by feel what has happened. The iron is cooled, i.e. has lost heat, and the water has gained heat and is now warm. Heat has passed from the hot iron to the cold water.

Can heat pass from a cold to a hot thing? What happens to a snowball held in the hand? The snowball takes heat from the hand, becomes warm and melts, the hand becomes cold. Where does the heat go to when the tea becomes cold? Heat always goes somewhere, it cannot be destroyed. Heat travels only from a hot to a cooler body. A child holds a wooden and metal spoon in boiling water; the metal spoon feels hot, but not the wooden spoon. Why does mother use a wooden spoon to stir the hot jam in a preserving pan? Why is a kettle-holder used? What is it made of?

Rods of different metals may be held with one end in a flame to show that all metals are good conductors. Similarly, rods of glass, wood, *bone* knitting needles, etc., are seen to be bad conductors. *Note.*—Many knitting-needles are now made of extruded plastic material, and these will soften in the flame.

Establish that wool, cork, fur, etc., are bad conductors. Woollen underclothing to prevent loss of body heat. The tea-cosy to keep the tea warm. The same tea-cosy to keep the iced lemonade cool.

Air is a bad conductor; a bird in winter puffs out its feathers to hold a non-conducting layer of air between body and plumage. Two thin shirts are warmer than one twice as thick (more air layers).

Poor people may use newspapers for blankets, many sheets of paper, many layers of air. *Haybox cookery:* A saucepan of hot stew is placed in a box padded loosely with hay, and goes on cooking. Hot-water pipes are covered with non-conducting material, and cold-water pipes are kept from freezing in the same way.

In most of these cases it is probably the enclosed air that acts chiefly as non-conductor.

(2) *Radiation*

When you warm your hands in front of the fire, how does the heat get from the fire to your hands? Air is a bad conductor; a lighted candle held in

front shows the flame being blown towards the fire, so it cannot be hot air coming from the fire. How does the bread get toasted? Why does the washing hung in front of the fire become warm?

Most children will need help here. They may be told that a fire sends out rays of heat as well as rays of light. They will understand better if reminded of the warmth of the sun's rays.

We feel the heat when the sun shines on us. How does the heat get to us from the sun? We only feel the direct heat when we are standing in the sunshine so that the sun's rays reach us. When we move into the shade, the rays do not reach us, and we do not feel the heat. If the sun is shining brightly, place in the direct rays of the sun a smooth board with one half painted white and the other half black. After some minutes it will be found that the black half feels much warmer to the touch than the white half. This experiment works well in summer sunshine, but not so well in winter. As a substitute, two similar mercury thermometers may be used, the bulb of one being blackened with lampblack or by dipping into black poster paint. The black-bulb thermometer will show a higher temperature than the other one, even in winter sunshine or when both are held in front of a fire or radiator.

A black surface *absorbs* rays of heat better than a white one. This statement can be extended as follows: black or dull surfaces absorb heat, white or shiny surfaces reflect heat. In summer sunshine a girl wearing a black dress feels the heat more than a girl with a white dress.

Children may think of other examples of white things absorbing less heat than dark things. The park seat painted white is cooler than one painted a dark colour. A white marble step feels cooler than a dark slate one. Workshops with slate roofs are warm when the sun shines, and are sometimes whitewashed in summer.

The fact of good absorbers being good radiators should be avoided for the present. Children can assimilate the idea of luminous heat-rays, but not of dark heat-rays. The question of convection also is better left until later. In spite of these omissions, a vacuum flask can be shown and a diagram drawn on the blackboard. It may be described as one bottle inside another, and it is as well to exaggerate in the drawing the space between the inside and outside bottles. Then children may be told that this space is empty, even the air having been pumped out. There is therefore nothing to conduct heat from the outside to the inside, or vice versa. In addition, the inside of the outer bottle and the outside of the inner one are silvered, so any rays of heat trying to get in or out are reflected back again. A vacuum flask, then, will keep a hot liquid hot and a cold liquid cold.

Children's Activities

(1) New words learnt: conductor, absorb, radiate, vacuum, absorber, radiator, etc.

(2) Make a list of all the good conductors you can think of, and another of all the bad conductors.

(3) If you wanted to prevent a block of ice from melting, would you put it in a tin box, or in a wooden box, or wrap it up in a blanket, or in a piece of newspaper?

(4) Which would be most useful in summer—a white or a black parasol?

(5) Cold-water pipes are sometimes wrapped with sacking to prevent them from freezing in winter. When do you think this should be done, before or after the cold weather comes? Would it do any good to wrap the pipes after they have frozen?

Some Effects of Heat: Change of State (1)

Required: Wax, lead, etc., for melting; some moulded articles to show; salt, sugar, alum, test-tubes, crucibles, etc.

Heat makes many things melt, e.g. ice, butter, wax, lead. Here discuss some differences between a solid and a liquid. A solid has a definite shape, a liquid takes the shape of the vessel which holds it. A liquid can flow or be poured, a solid cannot.

Observe that some things melt more easily than others. Ice melts before butter, wax melts before lead. Lead may be melted in an iron spoon or porcelain crucible over a bunsen. Iron requires greater heat. Liquids go back to solids on cooling. If we can melt a solid, we can pour the liquid into a mould and so on cooling obtain a solid of the shape we require. Mention a jelly or blancmange made in a mould. The cast-iron legs of the school desk are made by pouring molten iron into moulds made of a mixture of sand and clay. Lead soldiers are made in a similar way.

Note.—The hollow lead toys are usually cast in an iron mould made in two halves; a little lead is poured into the cold mould, a sudden twist given to the mould to spread the molten metal all over the inside surface of the cold iron. The lead solidifies at once, and on opening the mould the hollow toy can be taken out. This need be mentioned only if children ask why lead soldiers, etc., are hollow.

An attempt at moulding by the teacher should be done with caution, and only after preliminary trial. The moulds should be simple, e.g. a test-tube for molten wax. When the wax has set, the test-tube may be held in hot water for a few moments to melt the outside layer. If the test-tube is now inverted, the rod of wax slides out. The wax should be first melted in an evaporating basin not more than half full, and the basin lifted with crucible tongs. A piece of cardboard should be at hand to place over the basin should the wax take fire. Lead moulding is better omitted, but should the teacher decide to try it, an empty eggshell makes a good mould. Beware of the spurting of lead if poured into a wet mould.

Children should be kept away from the demonstration bench during moulding operations.

Melting and dissolving are two terms frequently confused, and the difference must be brought out. Sugar does not *melt* in the tea nor salt in water. Molten things are still visible, and we know they will become solid again on cooling. The sugar in the tea and the salt in the water cannot be seen and cannot be lifted out again even if the liquid is cold. We know they are there, however, because of the taste. We say they have *dissolved*.

How can we get the salt from salt-water? The teacher may pour some salt-water into an evaporating basin and boil away the water, leaving the salt for children to taste. Another basin of solution is left in a shallow dish to evaporate (dry up). Mention that in hot countries, e.g. shores of Red Sea, water from the sea is run into pits dug in the

ground and allowed to dry up, so that salt may be obtained.

Most substances (not salt) dissolve more in hot water than in cold. Dissolve as much powdered alum as possible in cold water by shaking in a test-tube, leaving some undissolved alum in the bottom of the tube. Now heat the test-tube, and the rest of the alum dissolves. Allow to cool, and crystals of alum appear, as the cold water cannot dissolve as much as the hot. The word "crystal" may be introduced without definition. The varied and beautiful shapes of crystals may be mentioned, and any available exhibits shown.

The making of sugar candy may be attempted. Use 3 lb. of sugar to a pint of water. Heat gently to form a syrup; then boil and allow to cool slowly with a soft string hung in the syrup for the crystals to form on.

Some further work on solutions may be done according to the discretion of the teacher and the intelligence of the class. The word *solution* should be used. A solution could be filtered; also some water in which powdered chalk has been shaken up. A solid is not removed from solution by filtering.

The widespread nature of solutions and their importance in the scheme of life may be dealt with. Some examples of solutions are: sea-water; all liquid foods, including the soil-water taken in by plant roots; practically all drinking water, as shown by the furring of kettles; the blood and the gastric juices of the body. Without solutions life as we know it could not go on.

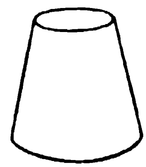
Children's Activities

(1) New words learnt: mould, casting, melt, dissolve, solution, crystal, evaporate;

(2) If you had some salt mixed with sand, how could you separate them?

(3) Mention some of the troubles we should have if there were no solutions.

(4) If you wanted to mould a shape like this



where would you have the opening in the mould, and why?

Change of State (2)

Required: Beaker, kettle or boiling flask fitted with cork and side tube, bunsen, etc. Some ice.

Boiling and Evaporation

Heat can make liquids boil. For the time being the study of water turning to water vapour, and of water vapour condensing to water, is all that need be attempted.

A large beaker is half filled with cold water, placed on wire gauze or an asbestos mat on a tripod, and a bunsen lighted underneath. The children are asked to observe and note what happens. At first small bubbles are seen to rise to the surface of the water. A thermometer placed in the water shows it to be well below boiling-point. These cannot be bubbles of steam. Children may guess what they are; if they are reminded that fishes are able to live because they breathe the air dissolved in water, they should be ready to agree that the bubbles are probably bubbles of air. Later, as the water becomes hotter, other bubbles are formed, becoming larger and larger as the heating continues. They burst at the surface with a crackling sound. Mention the singing of a kettle just before it boils.

The singing is due to the bursting of innumerable small bubbles of steam. Many little pops make a singing note—compare the pop-pop-pop of a motor-bicycle, which changes to a hum as the pops succeed each other with greater frequency. Note the temperature when the water boils. Can we see the steam?

Before we answer this question we will look at a boiling kettle or, failing this, at a boiling flask with cork and side tube. This should have been heated up in readiness.

A white cloud is seen; is this steam? The probable answer is "yes." Leave this for the moment and ask if the white cloud looks like anything seen out-of-doors. Compare with the white fleecy clouds in the sky. Are these steam? Are they hot like steam? Aeroplanes sometimes fly through clouds. Do the pilots get scalded? Look again at the white cloud coming from the spout. The cloud appears to start about half an inch away from the spout.

Now make the statement: The steam as it comes from the spout is invisible, but soon cools in the air again to many very tiny drops of water. We can call this *water dust*. The white cloud is made of water dust.

Hold the flame of a bunsen under the white cloud. The cloud disappears as the drops of water are boiled away again to steam. The white cloud may not scald, but a hand placed in the invisible real steam near the spout would be very badly scalded.

Another name for the invisible steam is *water vapour*. The white cloud of water dust disappears after a time. Even without heat it changes to water vapour (cold) and mixes with the air.

A saucer of water slowly dries up, so do wet pavements, wet sheets hung on the line, etc.

Water exposed to air slowly turns to water vapour. We say it evaporates.

How can we prove that there is water vapour in the air?

A piece of ice is placed in a glass of water. Before long a mist forms on the outside of the glass. A finger wiped round the glass becomes wet. The cold glass has cooled the air near it, and the water vapour in this air has turned back to water. It has *condensed.*

Compare the mist on the inside of window-panes when it is cold outside.

If there is a cold-water pipe running through the classroom, condensed moisture may perhaps be found on the outside of the pipe. Why?

When air is cooled sufficiently, some of the water vapour it contains condenses to water dust.

The clouds in the sky are formed in this way in the cold upper regions of the atmosphere. If the cloud cools still further, more water condenses and the drops become bigger. The cloud begins to look darker, and when the drops become big enough they fall down as rain.

Trace the journey of the raindrops: Evaporation from the surface of the sea; winds carry the water vapour over the land, water vapour condenses to rain, runs into rivers, etc., and finally back to the sea.

Damp winds and dry winds: Air which travels a long way over the ocean becomes laden with water vapour. Air travelling over vast tracts of land, e.g. the continent of Europe, obtains little water vapour.

Which winds, then, are the rainy winds? Which come from over the ocean and which from over the land?

A chart may be kept in which the wind direction is inserted each day, and in an adjoining column a note of any rainfall or a wind-rose may be made. Directions for making a wind-rose will be found in Volume III, GEOGRAPHY. By making this chart and filling it up each day, it will be clear at the end of a month which winds are the rainy winds and which winds blow most often.

Some children have the idea that clouds burst on mountains and bring rain. It might be explained that moisture-laden winds, not being able to go through the mountains, rise and so become cooled, perhaps sufficiently to deposit their moisture.

Children's Activities

(1) New words learnt: vapour, condensing, evaporation, water dust.

(2) Tell a story about a raindrop and its wanderings.

(3) Make your own wind-rose and find out which are the rainy winds.

(4) Draw a map of England, put in the mountains. Shade the map where you think the wettest parts of the country are likely to be. Perhaps later you can find a rainfall map and compare it with your own.

CHAPTER FIVE

MATERIALS, SUGGESTIONS, AND ACTIVITIES FOR FOURTH YEAR'S WORK

THE work done in the fourth year will be largely an amplification and extension of the previous year's work.

Animal study may be rather more critical and the salient features of different types of animals will be dealt with. There should be an understanding of the meaning of the terms "warm-blooded" and "cold-blooded." Children will now be able to appreciate that some types of animals are more highly developed than others. Fishes, for example, have a more complicated structure and a more varied and active life than earthworms, but in turn are less highly developed than the mammals.

Examples of several types may be studied in some detail, but still in an elementary fashion and without too much stress on cause and effect. It must still be remembered that the children are constantly gaining new experiences of life. They are enlarging their outlook, but are not yet ready to be made into little scientists.

The knowledge of plant life already gained will be crystallized and further notions developed of the internal economy of plants. Carbon assimilation in plants may be introduced in a simple way and the carbon, oxygen, and nitrogen cycles in Nature presented. Elementary ideas of heat, light, sound, and electricity will be developed and linked, where possible, with what is known of the life-processes of animals and plants. The work of great scientists will be related with stress on the romantic side of the work and on the debt mankind owes to them. The outlook value of the science teaching should always be in evidence, even if this entails digressions into the other branches of study.

Note.—The Related Science Section, or at least the lessons on burning and breathing, should be taken first, in order that children may understand the references to carbon dioxide and oxygen in the lessons on germination and on carbon assimilation of plants.

I. Animal Life

Spiders

Required: Plate XVI, spiders in insect cage; an actual web, if possible, of a garden spider, on a small shrub or cut-off branch; magnifying-glass.

Who knows any poetry about a spider? "Will you walk into my parlour . . ."

Is a spider an insect? Examine a spider or its picture. A house spider may be put in an insect cage with a little crumpled paper or a bare twig.

Sprinkle with a little water, and place a piece of wet flannel on the bottom of the cage. Put in live flies from time to time. Probably the weaving of the web and other activities may be watched. The spider is found to have eight legs and a body in two parts. True insects have six legs and a three-part body. A spider is not a true insect.

Where are spiders' webs found? Indoors, in odd corners and out-of-the-way places where the broom of the housewife does not often penetrate. Out-of-doors the webs stretch from branch to branch of trees or across spaces in fences, etc.

A magnifying-glass will show that the spider has eight eyes, one group of four and two groups of two. The mouth is guarded by two poison fangs, which fold over the lips like the blades of a penknife when not in use. The four pairs of legs are jointed and end in claws, on the inside of which are little teeth which give the claws the appearance of small combs.

At the end of the abdomen are the spinnerets, consisting of protuberances perforated with many small holes. From these holes comes the liquid which solidifies on reaching the air, forming many slender threads which join together to form the silk of which the web is made.

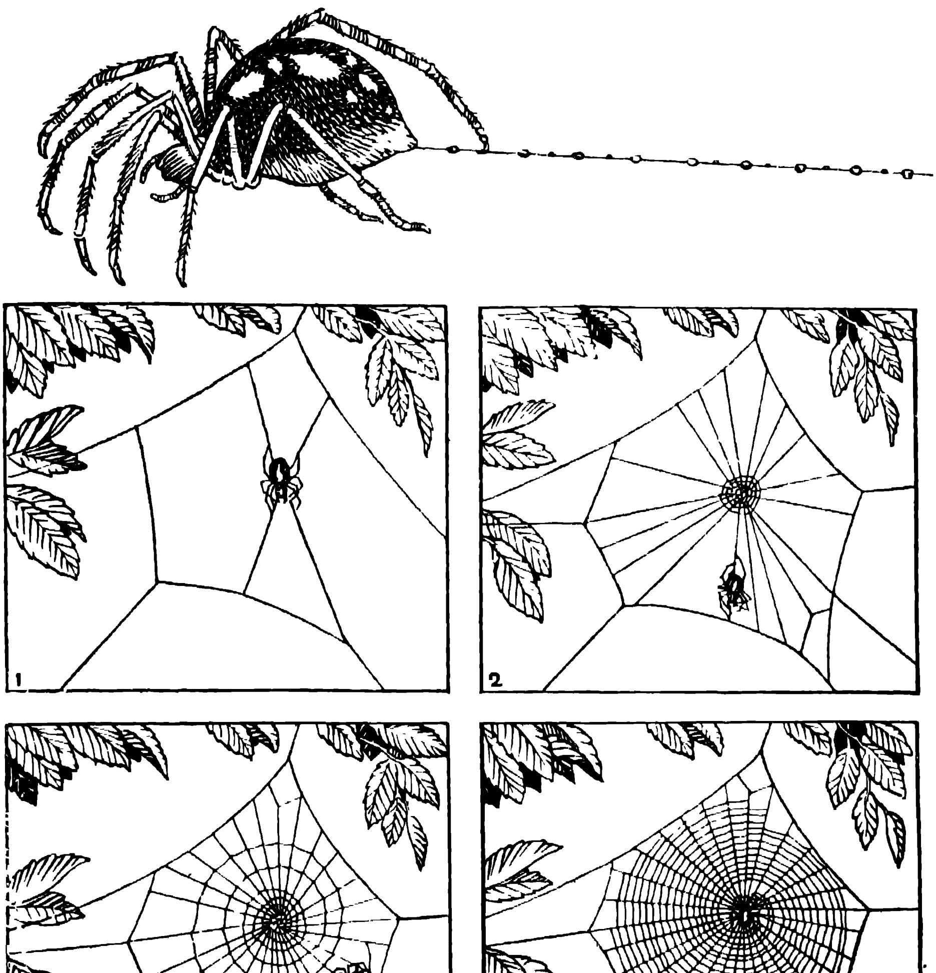
It is not necessary to talk about the breathing arrangements of spiders, but the teacher will no doubt bear in mind that an insect has no lungs, but takes in air through small holes or spiracles on each side of its body. A spider, on the other hand, possesses a rudimentary pair of lungs, known as lung books. On the under surface of the body, in front of the spinnerets, are two transverse slits which communicate with cavities inside the body. Each cavity contains a lung book, consisting of many white sheets arranged like the leaves of a book. Each sheet is a thin bag containing blood, and through the thin membranous covering an exchange of gases takes place, oxygen going from the air to the blood in exchange for carbon dioxide. The lung books bear more analogy to the gills of a fish than to real lungs.

Of much greater interest to the children is the way a spider makes its web. In summer it is not difficult to find a garden spider in the act of web-making, and the time spent in watching is time usefully spent. Starting from a branch of a tree or other plant, she spins a thread, fastens the end to the branch, and lets herself down to a lower branch, spinning out her thread as she goes. After pulling the thread tight and fixing it, she next sets out to make a horizontal thread. Usually she crosses the gap by a circuitous route, holding the thread away from obstructions with her comb-like claws. Or she may hang down by a long thread and allow the wind to blow her across the gap. She continues in this fashion until a frame of four or five sides is made.

The spider now moves to the centre of the top horizontal thread and lets herself down to the lower one, fixing the thread here at the centre also. Then she climbs half-way up the new vertical thread, begins another thread, and continues her ascent, holding the new thread away from the one she is climbing. The new thread is fixed to the top of the frame, a short distance from the previous one, and another commenced in the same fashion. This work is continued until the web has roughly the appearance of the spokes of a wheel.

The next task is the building of the resting platform at the centre by laying threads across the spokes very close together. The outer threads are more widely spaced, and are in fact only the temporary scaffolding which is laid fairly quickly and appears to serve as a bracing for the spokes. Having laid the bracing threads and arrived at the perimeter, the spider begins to work back and lay the permanent threads with greater care. When the web is complete, the bracing threads are gathered up and in some cases eaten.

Examine the threads under a glass. Sticky beads are seen on the cross



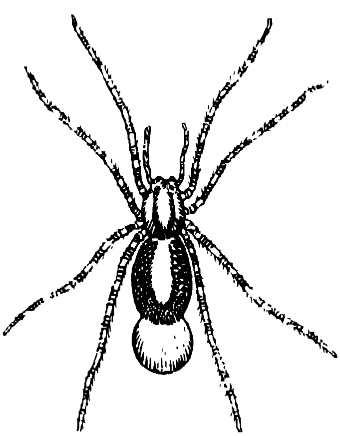
Spider Spinning a Web.

MAGNIFIED THREAD OF SPIDER'S WEB.

threads except at the centre, where the spider sits waiting for a victim. In some cases the spider, instead of waiting at the centre of the web, hides, usually in daylight, near the web, but in this case a thread attached to the web acts as a warning-line. The spider, with one hindfoot resting on the thread, feels the vibration of the web if an insect becomes entangled.

The spider kills or paralyses its victim by a bite with its poison fangs, but if the insect is too large to be approached directly, the spider turns her back and sends out thread from her spinnerets, turning round and round until the victim is bound and helpless.

Why does the spider not stick to the threads? Here mention the French naturalist Henri Fabre, who spent most of his life in watching and studying insects, and wrote books on his observations. He imagined that the legs and body of a spider are oily or greasy, and to prove this he carefully washed the legs of a spider in benzine, and on putting it back on the web found that it did stick to the outer threads.



WOLF SPIDER AND SILK-BALL OF EGGS

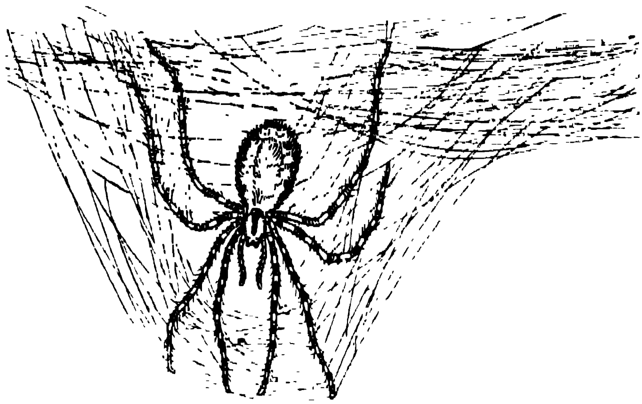
The female spider is usually four or five times the size of the male, and most of the large webs are spun by the female. The male is very much afraid of his wife and approaches her with diffidence, ready to flee should she not welcome his advances, for she is much more likely to attack and kill him than to receive him amicably.

The spider does not appear to devour its victims, but sucks them dry and then leaves them. The three most common types likely to be noticed are the house spider, with hairy legs and body, which fashions a close-mesh web in odd corners; the garden spider, the building of whose web has been described; and the wolf spider, also to be found in our gardens.

The wolf spider builds no web and has no fixed abode. It is very active, and able to chase over the ground after its prey. The most remarkable thing about this spider is the great care taken by the mother of her offspring. Before laying her eggs, she prepares a bed of gossamer. About fifty eggs are deposited on this silken sheet, which is then gathered up under the spider's body and carried about, looking like a large white ball, until the young spiders hatch out. Even then parental care does not cease, for the young spiders now climb on to the mother's back, holding on by grasping the hairs on her body.

Try to capture a wolf spider and the young immediately scatter and scuttle for cover, returning as soon as the danger is past and climbing up the mother's legs on to her back.

The garden spider also lays her eggs



House Spider.

in a silken cocoon, but this is yellow, contains two or three hundred eggs, and is tucked away in a crack or hole to hatch out in spring.

The house spider weaves a close web known as a cobweb; if undisturbed by the housewife, this web may eventually become very large. The spider hides in a silken tube which is usually part of the web. The house spider thrives well in captivity, and a large female spider captured in spring and placed in a large glass jar, as already described, may later be seen weaving her egg cocoons; later the little spiders may be watched as they hatch out. Neither the garden spider nor the wolf spider take well to captivity, but the house spider seems to be quite content provided she is fed with live flies and her web kept moist by sprinkling with water.

Country children, and some town children who live in houses with gardens, will no doubt have noticed on autumn mornings the countless gossamer threads lying on the grass, spreading over bushes, and floating in the air. These threads are spun by young spiders and, still attached to the spinnerets, are lengthened until they float away in the breeze, carrying the little spiders perhaps to great distances. Some at least, finally arriving in new places, have a chance of survival. Compare this scattering of the young spiders with the scattering of seeds by many plants.

Most spiders hibernate in winter, but indoor spiders in captivity continue active if kept warm and well fed.

Children's Activities

(1) New words learnt: spinning, weaving, spinnerets, lung slits (lung books), gossamer.

(2) Find the web of a garden spider. Drop on it a dead insect or a rolled-up blade of grass. What does the spider do?

(3) Keep a spider in a jam jar, as you have been shown; make notes of the things you notice from day to day.

(4) Make three lists, showing the differences between a house spider, a garden spider, and a wolf spider.

(5) Draw the web of the garden spider. Look at a garden spider carefully. Try to draw it. Notice the markings on its back.

The Bee (Plate XVII)

Required: Piece of honeycomb; a visit to a hive if this can be be arranged.

Remind children again of the form of a true insect: three pairs of legs, and body divided into head, thorax, and abdomen; some have wings and some are without.

The honey bee is always of interest to children, probably on account of its association with honey and sweetness. If the teacher is a beekeeper, no help

will be needed for this lesson, but the non-beekeeper must rely on general knowledge, unless some child's parent is a bee expert and is willing to provide exhibits or even a demonstration. Children already know that the bee gathers nectar for the hive and carries pollen from flower to flower. It may be news to them that she also gathers pollen for the use of her community. This is deliberately, not accidentally, carried to the hive.

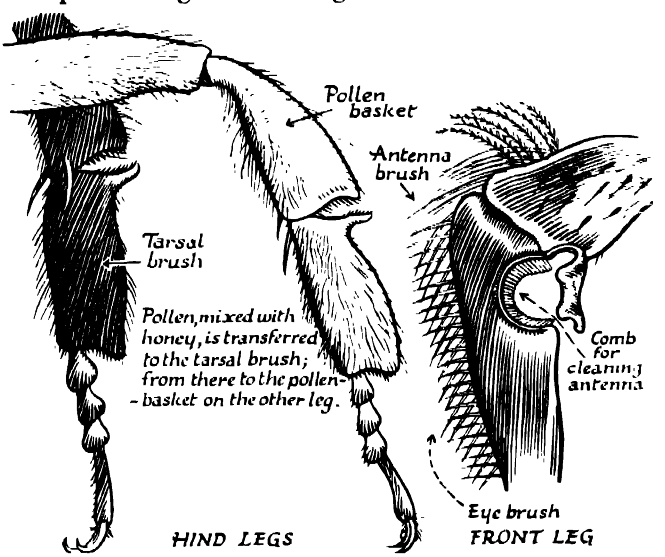
Bees' legs, mounted on microscope slides, may be examined with a glass or a low-power microscope. Note the hairy legs and the grooves on the inside of the last pair, for carrying pollen. The bee scrapes her back from time to time with her legs, until these are loaded with pollen. She then returns to the hive, where the pollen is kneaded with honey to form the bee bread with which the young bees are fed.

The activities, rather than the anatomy, of bees should form the chief part of this lesson. In the hive there is a queen, larger and longer than the others, whose sole duty is to lay eggs. The drones, rather smaller, do no work in the hive and gather no honey. One of them will have the duty of fertilizing a queen, after which he dies. All the honey-gathering and the general work of the hive is done by the workers, which are slightly smaller than drones. Besides collecting honey and pollen, they feed and nurse the developing larvæ. This duty appears to be performed by the younger workers. They also clean up the hive, and when necessary cause ventilation currents by wafting air into the hive with their wings. In addition they build the comb, and this is a long and arduous task. Note the hexagonal shape of the cells; hexagons fit together and leave no spaces when built up side by side.

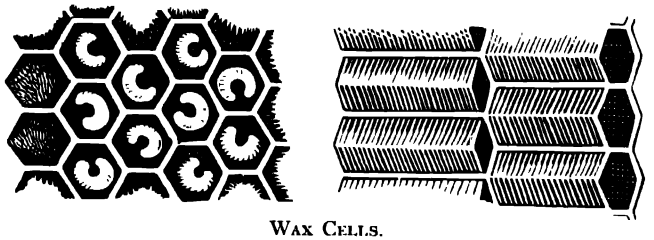
It is instructive to cut out regular polygons with five, seven, eight or more sides and show that none of these can be packed closely; there are always some waste spaces.

The queen bee lays many eggs, one in each cell; some cells are larger than others and are known as royal cells. These will produce queens.

The young grubs hatch out in about three days and are then fed by the workers, at first with "pap," a kind of secretion from glands in the workers' bodies, and later with bee bread. The grubs which are to develop into queens receive more food than the others, and also a special kind of pap known as "royal jelly." While this is going on, other cells are being filled with honey,



LEGS OF BEE, MAGNIFIED.



WAX CELLS.

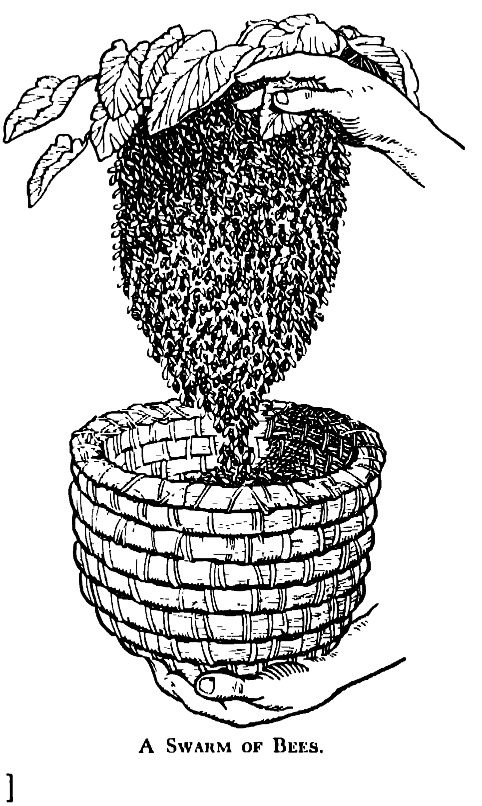
which is the bees' store of food for the winter. The young grubs in the cells are fed for about a week, after which the open end of each cell is closed. The grub then spins a cocoon and passes into the pupa stage, which lasts about ten days. It then leaves the cell as a young bee, ready to help in the work of the hive.

By about July the hive is becoming too full of bees and swarming-time arrives. The queen, followed by many of the workers, leaves the hive and flies away to the branch of a tree or other suitable resting-place, where all the bees hang in a thick cluster, known as a *swarm*.

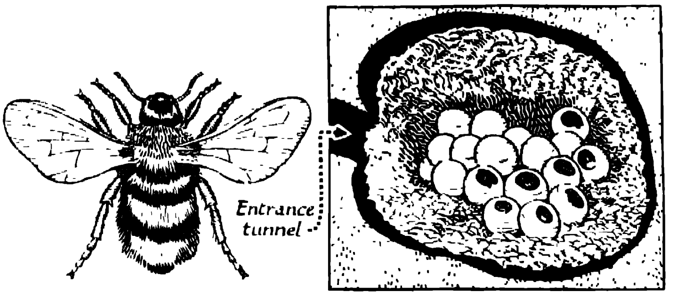
The experienced beekeeper is prepared for this, and follows the swarm with an empty box or skep, into which he shakes the swarm from the branch. The box is then kept loosely covered until evening, when the swarm is transferred to a new hive, either directly or by unloading it on to a sheet in front of the entrance. In this case the queen enters the hive, followed by her subjects. Thus a new colony is formed, while in the old hive one of the young queens takes charge. Usually she begins her reign by killing all the rival young queens, for only one queen is supported in a hive. Sometimes, however, one of the other young queens may leave the hive followed by a second swarm.

The drones are killed off as winter approaches, for useless mouths are not wanted when food may be scarce. The drones have no stings, but both queens, and workers have stings.

A bee stings when it is angry or molested, but if not disturbed there is little fear of a sting. The beekeeper, in opening the hive for any purpose, does so with deft and careful movements in order not to annoy or excite the insects. When he wishes to collect some of the honey, he blows a little smoke into the hive. This startles the bees, and in obedience to a natural and probably inherited reaction they at once gorge themselves with honey in preparation for a possible time of difficulty. When fully fed they are quiescent and unlikely to sting.



A SWARM OF BEES.



BUMBLE BEE AND NEST.

Bees manufacture their own wax, but the beekeeper usually supplies them with wax in the form of sheets, which the workers draw out into cells. There being thus less call on the bees for wax production, they are able to expend more energy on honey collection and so the beekeeper obtains a greater yield.

The honey bee may be looked upon as tame or domesticated, but there are also several types of wild bees.

Humble or bumble bees are familiar to most children. Larger than the hive bee, they live wild in fields and make their nests in holes in the ground or similar places. A queen humble bee sleeps throughout the winter, and when warm weather comes searches for a place to start a family. Unlike the queen of the hive bees, she not only lays the eggs but builds the nest, cares for the young, and goes abroad seeking pollen and honey. Only when workers are produced does she get any help. When winter comes, the workers die and the queens hibernate in holes, ready to start a new colony in the following year. Humble bees have stings, but are less likely to use them than hive bees.

STING OF BEE, MAGNIFIED.

In regard to stings, children should be told that if bees approach them they are not likely to sting if the child keeps still and does nothing to excite the bee. The same, in general, applies to wasps. A bee leaves its sting in the wound, and if this is gently scraped out with the thumbnail at once, the pain will soon cease, unless the child is specially allergic to stings. Applications to the wound, such as the blue-bag or vinegar, are not now considered to help much, but they do no harm and may satisfy the young patient.

Wasps belong to the bee family and may also be mentioned. They build nests of a kind of paper, made by chewing up thin strips of wood torn from trees. The pulp thus formed is first fixed to some support in the roof of the cavity chosen for a home and slowly fashioned into an inverted cup, cells of the same material being built up inside, the inverted cup being enlarged and prolonged to form a roughly globular covering with an entrance at the bottom. Again it is the queen who does all the work of building, for only queen wasps can survive the winter.

Caterpillars and grubs of various kinds are captured by the queen for feeding the young brood. The first workers to be reared assist in future nursing and in the enlargement of the nest, but the summer is usually well advanced before wasps are numerous enough to invade our houses and steal the jam and sugar. Fertilization of the queens by the drones takes place in late summer, and as winter comes drones and workers die and the queens seek

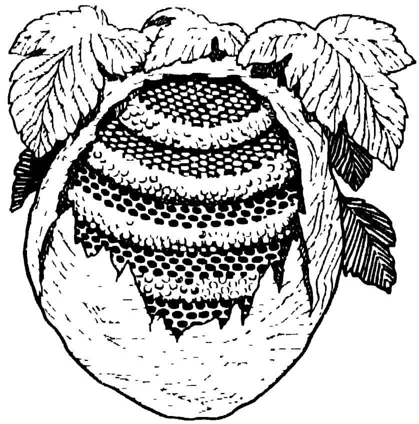
hibernating quarters in holes in walls, trees, or in haystacks.

ANTS (see Plate XVIII) also are members of the bee family, and here again it is the activities of the insects rather than their form that should be presented. The social habits of ants and the resemblance of their communal life to that of people may be dealt with. "Go to the ant, thou sluggard . . ." Even in Old Testament times the ant was regarded as an example of energy and industry.

Anthills, or other signs of the activities of the insects, may be found in gardens and other places, especially in pine woods.

A formicarium or ant-case may be made from two sheets of glass about twelve inches square, separated at the bottom and sides by strips of wood not more than a quarter of an inch thick. The strips may be stuck to the glass with seccotine, or held in position by string bindings or elastic bands round the glass. The case is filled with dry soil and some ants introduced. They will probably soon acclimatize themselves, and then many of their activities may be followed through the glass.

The home of the ants is a series of underground tunnels, made by the removal of soil a grain at a time. Common types are the black garden ants and the yellow meadow ants (Plate XVIII). The eggs and the grubs which come from them are stored in different underground chambers and are moved from one chamber to another as they develop. Worker ants attend to this, and spend much time licking the eggs, which slowly increase in size before they hatch out into grubs without legs. These grubs in turn are nursed by the workers, who transport them from one chamber to another, and even take them above ground on occasions to give them a sunbath. When the grubs finally pupate, the cocoons are guarded and tended also. It is these white cocoons which are sold by dealers as ants' eggs for feeding goldfish.



WASPS' NEST.

The family economy of the ant is similar to that of the bee. In late summer some of the pupæ develop into winged ants, some males and a few females. A nuptial flight takes place, the females are fertilized and become queen ants, whilst the males die. The queens either return to the old nest or go elsewhere to found a new colony. They lose their wings, or have them bitten off by the workers, and begin to lay their eggs.

In the nest a fertile queen is closely attended by a group of workers, who stroke her continually, feed her, gather up and store away the eggs she drops, and generally treat her with care and reverence. The queen may live and continue to lay eggs for many years.

The workers fulfil many functions besides that of servitors. They act as soldiers and repel invaders, make forays on other nests, and may even bring

back insects as slaves. If a nest is disturbed, they work feverishly to save as many of their immature members as possible.

Their food consists of the juices from fruit and flowers. It is said that ants keep greenfly as milch cows, and they have certainly been seen to shepherd the insects towards plants which provide suitable food. Ants are especially fond of the sweet juices which these creatures exude as they feed on plants.

Children should be induced to study the behaviour of ants in their natural state where possible, and to report on their observations. They might watch a particular ant on one of its journeys, and notice where it goes and what it does. Probably they will notice two ants meet and caress each other with their antennæ; this appears to be their way of communication, and probably orders are passed in this way from one to another.

Children's Activities

(1) New words learnt: hive, drone, pap or royal jelly, pollen bread.

(2) Imagine yourself to be a worker bee, and describe a day in your life.

(3) Do the same again, but pretend you are a queen ant this time.

(4) Find out from someone who keeps bees what is the difference between an old skep hive and a modern hive.

(5) Write down any poetry you know about bees or ants.

(6) Draw a honeycomb; make a pattern from it.

Flies, Mosquitoes, and other Insects (Plates II and VIII)

Required: Mounted specimens of mosquitoes, dragon flies, etc.

The house-fly has already been studied, but it is as well to revise what has been done and to emphasize the need for cleanliness in dealing with food. Something may be said about methods of keeping down the number of flies in houses and other places where food is kept. Well-known sprays and dusting-powders may be mentioned, especially those of the D.D.T. group. D.D.T. (diphenyl dicholoro toluene) is a colourless dye that has been produced after long and patient research.

Because of their tough, almost horny skin, many insects are not affected by contact poisons, and stomach poisons are useless, unless the insect feeds on them. D.D.T is not only poisonous to insects when taken by the mouth, but is also a definite contact poison, so that an insect walking over a surface impregnated with D.D.T. becomes paralysed and soon dies. The substance is not harmful to larger animals. It does not keep insects away by its smell, as does naphthalene (the substance of which moth-balls are made), but kills those which touch it. Clothing dyed with D.D.T. shows no change of colour, but the caterpillar of a clothes moth which began to feed on such clothing would speedily die. In the Second World War the substance was used with great success for preserving clothing and other military material from the attacks of moths and other insects.

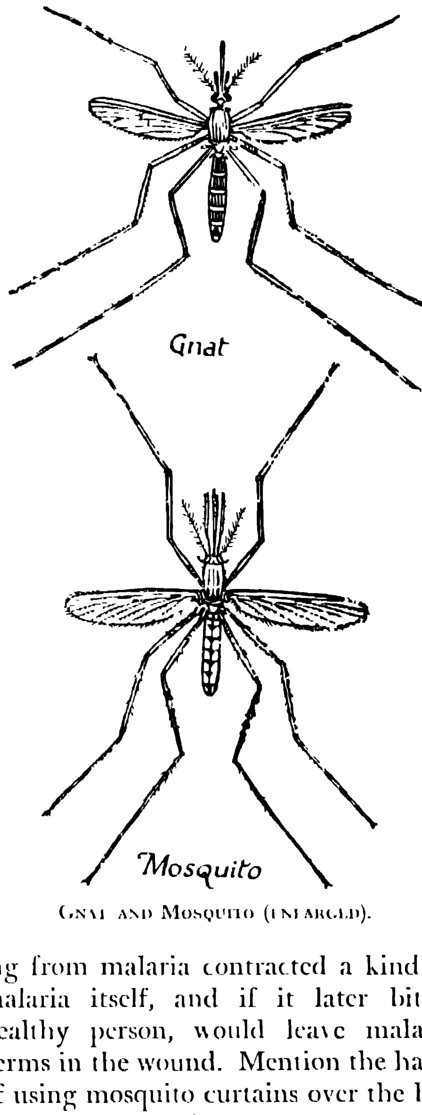
Although belonging to a different family, gnats and mosquitoes are, like flies, looked upon as insect pests. The malaria-carrying mosquito and the annoying gnat are very closely related. Both kinds of insects have similar life-histories. Children may be able to supply some information about gnats. The high-pitched note due to the rapid vibration of the wings (show how vibra-

tion produces sound by using a steel knitting-needle, held with one end in a vice, or by twanging the reed of a Jew's harp). The sting or bite will almost surely be mentioned, and possibly the fact that gnats are more numerous in damp places and near stagnant water. A brief mention only of the life-history should be made. The female lays her eggs in the water, where they stick together and float like rafts (two to three hundred eggs).

The grubs or larvæ are long and legless, they float head downwards, with the tails, through which they breathe, just piercing the surface. In a few weeks they turn to pupæ which float on the surface. Later the skin splits open, the winged insect crawls out, rests on the old skin until its wings are dry, and then flies away.

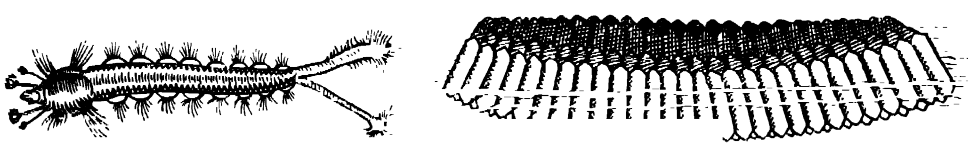
Gnats have a sharp trunk, or rather a set of five piercing instruments with jagged edges. All these darts are held close together when piercing our flesh for the purpose of sucking the blood, leaving a lacerated wound. Only the females bite, although the males possess similar appendages. It is quite correct to speak of a gnat as a mosquito, although the second name is more widely used to describe the insect in hot climates which carries malaria and yellow fever.

Something may be said about the work of Sir Ronald Ross, who made careful studies of the insect in India and other hot countries. He found that a mosquito which bit a person suffering from malaria contracted a kind of malaria itself, and if it later bit a healthy person, would leave malaria germs in the wound. Mention the habit of using mosquito curtains over the bed in malaria countries.



Gnat and Mosquito (enlarged).

Sir Ronald Ross suggested that the malaria plague could be abated if the number of mosquitoes could be kept


Larva of Gnat, and Eggs forming Raft, magnified.

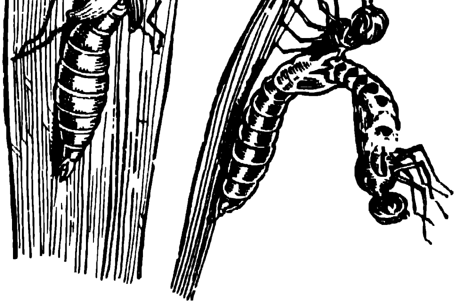
Dragon Fly.

down. As a result, many pools and swampy places where mosquitoes breed have been drained, and where this is not possible a little paraffin has been poured on the water. This spreads out over the surface to form a kind of liquid skin which the tail of the mosquito grub cannot pierce, so the insect perishes from lack of air.

De Lesseps failed in his attempt to construct the Panama Canal because yellow fever, carried by insects, killed off so many workmen. Later the Americans drained the swampy places and in other ways destroyed the insects, and so conquered the yellow fever.

Dragon flies always make an appeal to children, and they may be told that here is another case of an insect which passes the first stages of its life in the water. The female lays her eggs in the water, and the larva which hatches out spends most of its time on the bottom, hiding in the mud or among the stones and devouring other insects, tadpoles, and even small fishes. As it grows it casts its skin from time to time and grows a new one. There is no resting pupa stage, but a gradual change takes place in the larva. Wings begin to grow inside wing-sheaths, and the creature is now called a *nymph*. It frequently comes to the surface to breathe and finally climbs out of the water, usually up the stem of a plant. Here it appears to swell until the skin cracks along its back, and after much struggling the fly emerges from its sheath. Then it waits and rests until its body becomes stronger and its wings dry. This usually takes several hours, but at last the complete imago, with its long abdomen and gaudily coloured wings, is ready to fly away.

The *Caddis fly* in its mature stage may have little interest for children. In flight it looks like a tiny brown moth, and hundreds of the insects may be seen flying over water in spring. Their life as flies is short, usually a few days, but in that time they lay many eggs in the water. The grub is a soft-bodied creature, and as a protection builds itself a little case of small sticks, pieces of stem or root and even grains of sand or fine stones stuck together to make a tube (Plate II). Normally it



Nymph of Dragon Fly, and Fly emerging from Nymph.

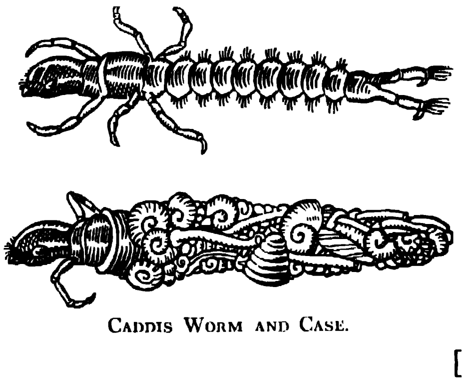
remains entirely inside the case, but for moving and feeding protrudes the front part of its body. The larval stage may last as long as a year, and then the grub spins a kind of silken mesh over the front of its case before becoming a pupa. This stage lasts about three weeks, then the pupa becomes active, leaves its case and swims to the surface, climbs up a plant stem, the pupal skin splits off and the adult fly emerges.

Caddis grubs in their cases may be found in ponds, looking like bits of stick. They may be put into an aquarium and will continue to thrive.

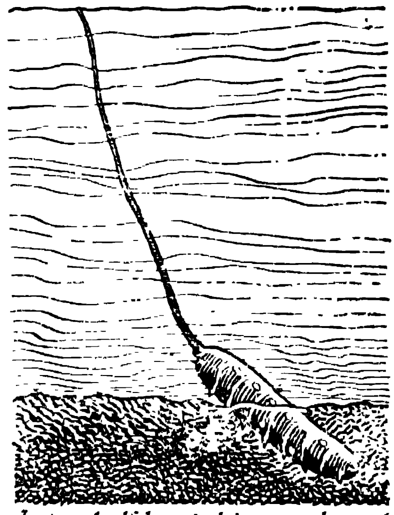
Drone flies are interesting in the larval stage, and in the adult stage look rather like drone bees, hence the name. The grub is found in stagnant water, especially water containing putrid organic matter. It is sometimes called a " rat-tailed maggot " on account of its long tail, which is a breathing appendage, and always reaches to the surface of the water.

If a grub is put into a tall jar containing a little water, and more water added, it will be seen that the tail becomes longer, so that its tip is always at the surface, although the creature remains on the bottom. It appears to have a telescopic tail.

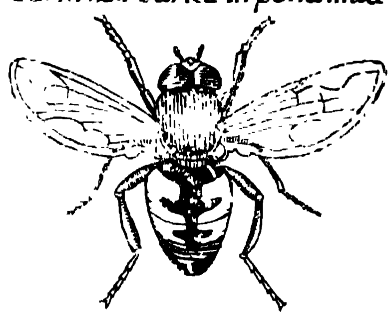
When the limit of extension is reached, the creature crawls up the side



Caddis Worm and Case.



Larva half buried in pond mud



Drone fly.

Drone Fly and Rat-tailed Maggot.

of the vessel until it can once more reach the surface with the breathing-tip.

No more need be said about the fly, the maggot being of chief interest.

Children's Activities

(1) New words learnt: nymph, naphthalene, etc.

(2) Mention some of the ways in which flies may spread disease.

(3) If you went to live in a house that was infested with flies, how would you set about getting rid of them?

(4) Find out from Volume II, Geography, in what parts of the world

malaria is common. What measures are taken to combat this disease.

(5) Look in a shallow pond for caddis worms. Put some in a jar of water with sand and pieces of bark on the bottom. Put sand on the bark to keep it from floating, but leave a bit of bark showing. You may use the jar to hold long-stemmed flowers, and perhaps the caddis worms will find food, small insects, etc., on the stems.

Warm and Cold-blooded Animals

Required: Skin of grass snake, or live snake, pet tortoise, pictures of reptiles, etc.

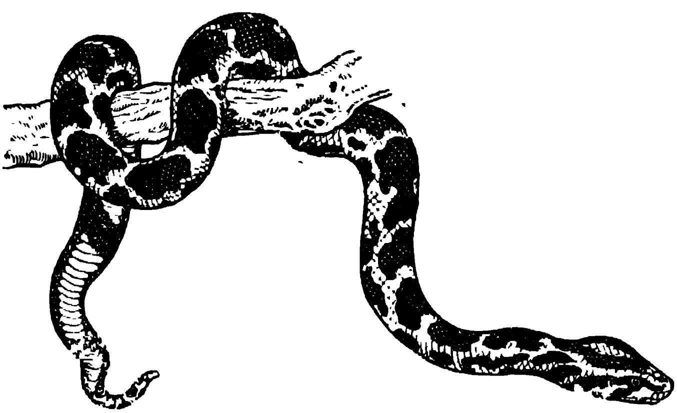
This should be a lesson on cold-blooded animals, warm-blooded animals being discussed only to provide a comparison. Ask for names of cold-blooded animals. Fish will almost certainly be mentioned, but worms, shellfish, amphibians (frogs, etc.), reptiles, and insects must also be classed as cold-blooded. Is a cold-blooded animal always cold? Does it always feel cold?

Remind children that the temperature of the human body is constant, whatever the air temperature; the same applies to cows, dogs, and other animals that we call warm-blooded. Cold-blooded creatures, however, have no means of keeping their own blood at a steady temperature. Their blood, and in consequence their bodies, always assumes the temperature of their surroundings, just as a basin of water is cold in cold weather and warm in warm weather.

In this country the air temperature rarely, if ever, reaches 98·6° F., so all cold-blooded creatures feel cold to our touch. But in tropical countries the air temperature may be 110° F. or more and so all cold-blooded creatures would at times have bodies warmer than ours. Most cold-blooded animals are more active in warm weather than in cold. Think of the frog, active in summer, sluggish or dormant in winter.

Snakes in warm countries are active in the day-time, but on cold nights their bodies cool and they become torpid. A python (one of the constricting snakes) is dangerous in India, but if brought to this country it would not have the energy to harm us.

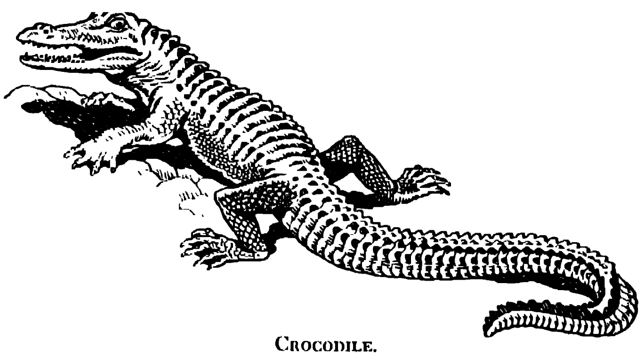
Snakes are classed as *reptiles*; so also are crocodiles, tortoises, and lizards. All reptiles are covered with scales; some, like the crocodile, have limbs, others, like the snake, have none. Cold countries do not suit reptiles very well. The large ones are all found in hot climates; in this country reptiles are small and seen only in the summer.



Python.

British Reptiles

The lizard, shy, harmless, inhabiting warm, sandy places. Hibernates in the winter. Legs clumsy-looking, tail long



CROCODILE.

and jointed. If an attempt is made to catch a lizard, it usually snaps off its tail, which continues to wriggle for some time, while the lizard quickly escapes and eventually grows a new tail.

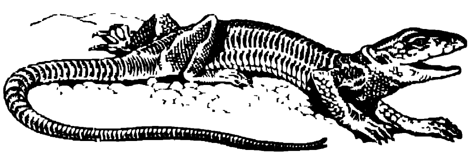
The slow-worm, or blind-worm, is a kind of legless lizard; it is neither slow nor blind. About one foot long, it is dark greyish-brown in colour, and has small teeth and a forked tongue. The forked tongue may cause it to be mistaken for a snake; it is harmless and, like the lizard, may leave its tail behind when chased.

There are two kinds of British snakes, one harmless and the other poisonous. The *grass snake* is about three feet long, and harmonizes well with the grass, has a white or orange collar behind the head, and vertical black marks along its sides. It feeds on frogs, toads, and newts, hibernates in winter, and can swim well. It is not venomous. As it grows, it casts or sloughs its skin from time to time. Lays about a dozen eggs, all connected in a string and about an inch and a quarter long. The snake is found all over England and Wales, but not in Northern Scotland.

The *viper* or *adder* is usually less than two feet long, has a large flat head and a V-shaped black mark on the neck, with the angle of the V pointing to the head. There are also zigzag black markings down the back. The adder hibernates in winter, and in summer lives on small animals, such as mice, frogs, etc. The viper has poison fangs, and its bite may cause severe discomfort, but rarely death. The mouth is too small for it to bite a leg or an arm, and in any case it is unlikely to bite unless molested.

Snakes in general have a backbone and ribs, but no sternum or breast bone. All the ribs, therefore, are floating, and allow a great distension of the body when bulky food is swallowed. The upper and lower jawbones do not work in a bony joint as in most animals, but are connected by an elastic ligament, which allows them to separate as if dislocated if a large object is engulfed. Backward-pointing teeth assist in forcing prey down the throat. The poison fangs are larger than the other teeth and have grooves down which the poison flows from a gland at the base. The fangs are hinged and lie back against the upper jaw, except when ready to strike. The eyes of a snake are not provided with eyelids, so a snake cannot shut its eyes. The forked tongue is an organ of touch, and has nothing to do with the poisonous bite.

The Tortoise, like the snake, is a reptile, and a pet tortoise makes a more pleasant exhibit for a lesson than a snake. Children can see that, like the snake, it is covered with scales. The so-



LIZARD.

called shell is really part of the body, the bones of the skeleton having flattened out and united to form a bony covering and protection just under the skin. We can say that a tortoise practically has its bones on the outside of its body.

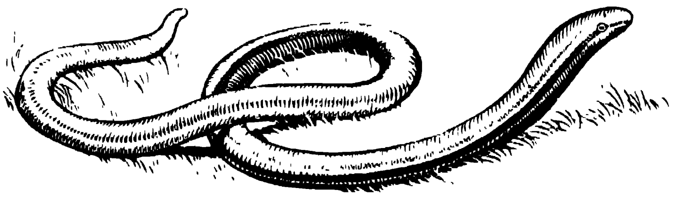
To sum up, we can say that our cold-blooded animals, apart from insects, include fishes, which live always in water; amphibians (frogs, toads, and newts), which start life in water and continue it on land; and reptiles, which are born and live on land, or at least, like other animals, are born with lungs for air-breathing.

Children's Activities

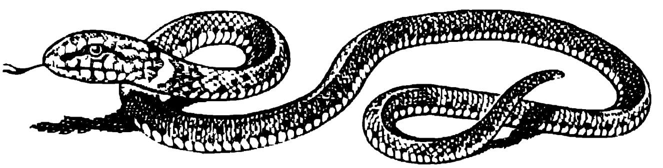
(1) Make a list of all the kinds of animals you can think of which have scales.

(2) Draw a grass snake and an adder, and put in the body markings. How could you tell an adder from a grass snake?

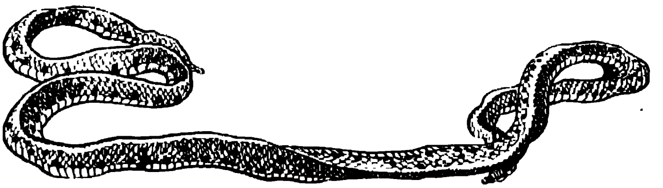
(2) Try to answer this riddle: when is the blood of a cold-blooded animal warm?



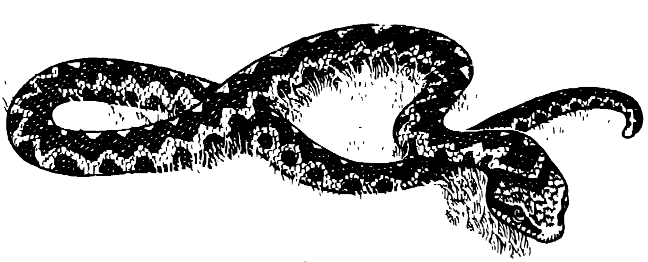
Slow-worm.



Grass Snake.



Cast Skin of Grass Snake.



Adder.

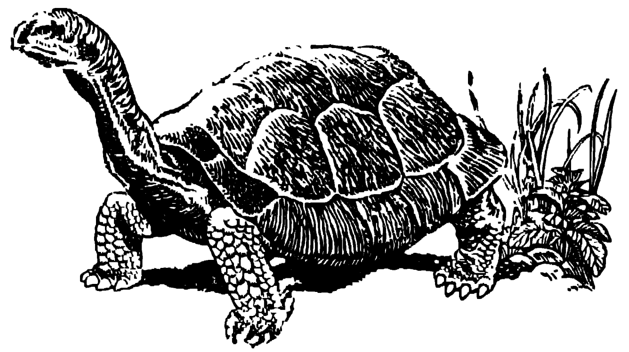
RODENTS OR GNAWING ANIMALS

Required: Tame rabbit, or white mice; pictures of rodents. (Plate XIX.)

Lessons on gnawing animals may be used, firstly to bring out the idea of families and family resemblances in animals; secondly, to foster an interest in wild Nature and inculcate habits of observation; and, thirdly, to point out the need for control of animals usually regarded as pests.

Children are already willing to admit that tigers and lions belong to the cat tribe, and wolves, etc., to the dog tribe,

but will probably be unable to suggest what animals belong to the rabbit tribe. If rabbits, hares, rats, mice, squirrels, and the dormouse are considered, it should not be difficult to elucidate that there are one or two points of resemblance. All are active, mostly live in holes, and are provided with large front teeth adapted for gnawing.



TORTOISE

The rabbit may be taken as a type. Country children will be able to supply much information themselves about the habits of the wild rabbit, but city children, although possibly acquainted with tame rabbits, and dead rabbits in butchers' shops, will need more help in regard to wild life. They should be told about the rabbit-holes seen in dry sandy banks, the way in which rabbits hop out in the evening, the way in which the brownish fur blends with the ground, and about the white patch under the tail, said to be used as a guide to young rabbits following in times of stampede.

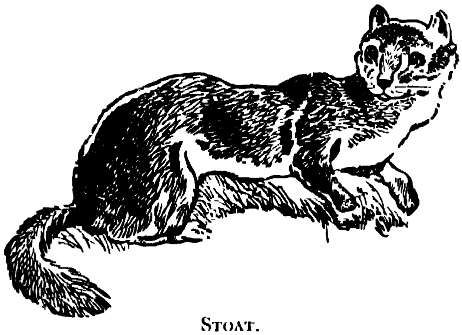
The holes or *burrows* are long and tunnel-like, joining up with each other to form a *warren*, and so giving alternative exits in case of danger.

Rabbits are prolific breeders, several litters being born in succession from February to September. The young are born in a specially constructed nursery burrow about a yard long, with a rounded hollow at the blind end. This is lined with fur from the mother's body, and the young rabbits, blind and helpless at birth, are left there for the first fortnight, after which they are able to run about and make short excursions from the burrow. They are able to look after themselves when a month old. Male rabbits are called *bucks*, females *does*. The natural enemies of the rabbit are the stoat and weasel; cats, foxes, and rats also take their toll.

Rabbits were introduced into Australia by settlers, and have multiplied to such an extent that they are now regarded as pests. In America they are called *conies*. The fur of the rabbit is used for making felt for hats, etc., and is also dyed and prepared to imitate sealskin and other expensive furs.

If a tame rabbit is available, it should be left free in the centre of a ring of children sitting on the floor.

The things to note are: the long hind legs, the hairy underside of the feet (no pads, as in the case of the dog or cat), the chisel-like front teeth, and the split upper lip. The front gnawing teeth are typical of the rodent family. The dentine of each tooth is protected at the front by a much harder coating of enamel, with the result that the back of the tooth wears away more quickly than the front, giving the teeth a permanently sharp chisel edge. These teeth are always growing, but the gnawing of bark and young shoots prevents them from becoming too long. The split upper lip makes gnawing more



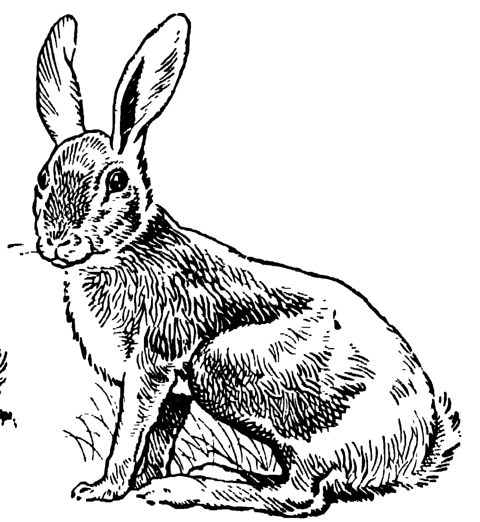
STOAT.

effective, as a continuous top lip would get in the way. The inside of the cheek has a hairy lining which serves to prevent splinters and dust from entering the throat. This hairy lining is typical of all rodents.

The hare is usually regarded as similar to the rabbit, but there are certain major differences. Apart from their greater size, hares have much longer hind limbs, and live a solitary life instead of in communities like rabbits. They also are non-burrowing animals, depending for their safety on the harmonizing of their coats with their surroundings, and on their speed and agility. The hare appears to be content to rest in a slight depression, known as a *form,* in the grass during the day-time, leaving this position at dusk to seek its food. It feeds on grass, bark of young trees, seeds, roots, etc., and displays a great liking for carrots, turnips, and other garden produce. The hare travels at a prodigious speed, but runs better uphill than down, the great length of the hind legs hindering its downward progress somewhat. It is a good swimmer and may cross a stream in search of food. On leaving or returning to its form, it adopts a zigzag course, interspersed with gigantic sideways leaps to break the scent. The young are born with their eyes open, and, unlike rabbits, able at once to use their limbs. A young hare is called a *leveret.*

Both rabbits and hares do harm to farm and garden crops and to young trees. Wire-netting will keep rabbits but not hares from a garden, hares being able to leap high fences if necessary. Rabbits, however, can burrow under the wire, unless this is sunk at least a foot below ground.

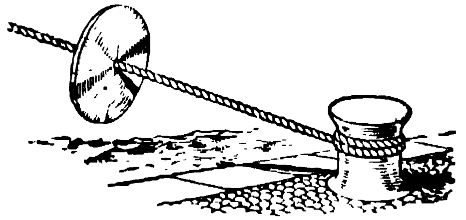
RABBIT.



HARE.

Rats and mice are less popular than hares and rabbits, but a knowledge of their habits is equally necessary. The rat especially is abhorred by all, for wherever man establishes himself the rat follows and steals his food, damaging floors, walls, and other materials in gnawing holes to get at stored supplies. The rat will eat practically anything, and few things are safe from his depredations. On account of his great reproductive power, resulting in four or five litters a year, he is extremely difficult to exterminate. The brown rat is the common pest in this country. It came in ships from abroad during the eighteenth century and practically exterminated the milder and less fierce black rat, which had been a native here since about the thirteenth century. It contrives to board every ship and get ashore via mooring-ropes, or even by swimming. Some children will have seen the various-shaped attachments to mooring-ropes to prevent rats from boarding a ship.

The farmer especially regards the rat as an enemy and in many cases offers a bonus to children who bring him rats' tails to show that the rats have been killed. When a cornstack is demolished at threshing-time, dozens of rats may try to escape from beneath, and a ring of men with sticks and dogs is formed in order to kill as many as possible. Rats carry disease, and are usually infested with fleas, which in turn have been known to spread plague. The chief aim of the teacher should be to impress on children the importance of all measures for rat extermination; the form and anatomy of the rat



A Rat Preventer

are too well known to need description.

The same remarks, but in a lesser degree, apply to the *house mouse*. The *long-tailed field mouse*, however, does more good than harm, for although it may eat some grain, it is responsible for the death of many grubs and other insects which would otherwise damage the crops.

The *field vole*, or *short-tailed field mouse*, is more harmful, for its appetite for roots and vegetables is greater, and its burrowing undermines banks and may cause earthfalls.

Water voles are inoffensive and do no damage, except possibly by the undermining of banks and dykes. They swim well, have usually an underwater entrance to their burrows, and find most of their food in the water or in ditches.

The *harvest mouse*, one of our smallest British mammals, is a pretty little creature about four inches long, half the length being tail. It inhabits the south of England chiefly, feeds on insects, but makes stores of grain for use in winter. Its nest, built among the

Long-tailed Field Mouse.

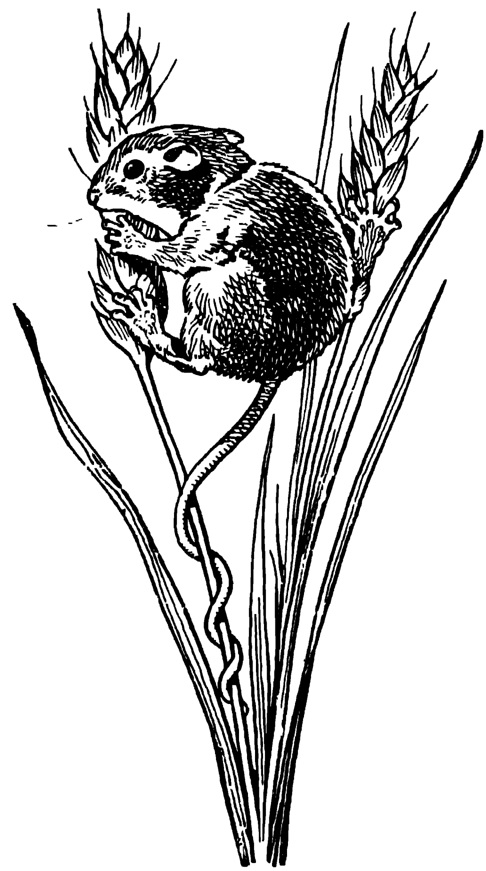
FIELD VOLE OR SHORT TAILED FIELD MOUSE

cornstalks, is a cleverly woven ball of blades of grass or wheat about the size of a tennis ball. The common enemies of all field rodents are stoats, weasels, and owls.

Squirrels are perhaps the most popular of the British rodents. This is due partly to their appearance and partly to the fact that they are frequently to be seen in the day-time. The red squirrel is the original native of this country, but in the Home Counties and much of southern England it has been replaced by the grey American squirrel, representatives of which have escaped from the London Zoo into Regent's Park and gradually spread.

The squirrel builds a nest, known as a *drey,* in a tree. It lives on nuts and fir cones, and eats fruit if available. The grey squirrel is known to do much damage to the fruit in orchards and gardens. It does not hibernate, but lays up stores of nuts for use in winter. In cold weather it sleeps profoundly, but on mild or sunny days wakes up and feeds from its store. The squirrel appears to be rather a haphazard maker of food stores, for it may make several stores of nuts which are apparently forgotten and left to rot. It is a nimble climber, and leaps easily from branch to branch, its long bushy tail acting as a balancing pole.

The dormouse has one resemblance to the squirrel, but in many respects is like the mouse. Its body is about three inches long. It climbs trees and nibbles nuts like the squirrel and has a bushy tail, though less bushy than that of the squirrel. It is nocturnal in habit and sleeps heavily in the day-time, so heavily that it is difficult to arouse, hence the expression " sleeping like a dormouse." It may be kept in captivity, but its habit of sleeping in the day-time makes it an uninteresting pet for children.



HARVEST MOUSE.

Children's Activities

(1) New words learnt: rodent, gnaw, burrow, warren, litter, buck, doe, conies, form, leveret, drey.

(2) Make a list of all the types of rodent you can think of. Then re-arrange the list, putting the most useful rodents at the top and the most un-desirable ones at the bottom.

(3) If you went to live in a house that was infested with rats and mice, what would you do in order to get rid of them? Of course you would set traps, but think of other things to do as well.

(4) What type of rodents would you expect to find in the following places? In pasture fields, in trees, in a corn-stack, in the banks of a stream, in a cornfield, in a garden, in a bakehouse.


SQUIRREL

THE FARM AND ITS ANIMALS

Required: Plate XX and other pictures of farm life; jawbones or teeth of cow, etc.; parchment.

The approach to this lesson will to some extent depend on whether the class is composed of town or country children. The first aim should be to produce a clear mental picture of a farm and its surroundings. With country children this could be elicited by questions, thus testing the children's powers of observation. Town children will no doubt offer many suggestions, but will need more guidance from the teacher.

In their lessons on home and local geography (see Volume III), country children will have learnt about and got many ideas from the farms around them. In the Geography Syllabus suggested for the fourth year, they study the Home Country, Great Britain, or Ireland, or whatever their country happens to be, in greater detail. Both town and country children learn more about different kinds of farms: fruit farms, dairy farms, sheep farms, wheat farms, according to what the farm specializes in. Some farms do not specialize, but carry on mixed farming. Town children may be helped to picture a farm by means of Plate XX, and by suggestions from the teacher. These suggestions introduce or revise useful words—the farmhouse is on or near *pasture* fields, *meadows*, cornfields, or other *arable* land. There are outbuildings, stables, milking-sheds, *pig-sty*, cart-shed, barn, fowl-house, a pond or other water near. Creatures that may be seen in the farmyard are cows, horses, pigs, fowls, ducks, geese, dogs, cats. No sheep, except for a possible motherless lamb, as these are away from the farmyard in the care of the shepherd.

Why do men farm? Obtain from the children a list of all the things the farm provides: food, clothing (from wool, flax, etc.), leather, as well as meat from the ox, and so on.

Farm routine: a general list may be made up of the daily duties performed on the different farms—milking, care of animals, feeding, cleaning, grooming, etc. It encourages thought to let the children gather together all they have learnt in their Nature Study lessons about soil, keeping down insect pests and other pests, growing fruits and vegetables, so that they realize they have acquired a good deal of useful information. They have also studied in some detail in their second year's geography course (see Volume III, Chapter VIII) the growing and harvesting of grain. They can now tell about this. When all this information has been collected, they will be interested to learn more about the creatures on the farm, and another important farm product, just as important as wheat, namely, milk.

Poultry and ducks have already been dealt with in lessons on birds, so may be passed over lightly here. The four-legged animals of the farm all have hooves, hard and horny. Cows, sheep, and pigs have cloven hooves; the horse's hoof is all in one piece. The horse has only one toe on each foot, and this is protected by a toe-nail, grown strong and hard to form the hoof. We can therefore say that the horse walks on its toe-nails.

The other animals, the ones we may eat as food, have two toes each, and these spread out as the animal walks to give a surer foothold in rough places. In the cow and the pig vestiges of two more toes are found behind the hooves. In the case of the pig these are known as *dew claws*; they spread outwards and backwards as the pig walks in muddy ground, to prevent the hoof sinking too far into the mud.

Cud-chewing animals: cow, sheep, goat, deer, antelope, giraffe. These are called ***ruminants***, and chewing the cud is called ***ruminating***. Why is cud-chewing necessary? Remember that our domestic ruminants are descended from animals that once ran wild like the deer. Grass requires much chewing, and if wild ruminants chewed as they ate, their whole day would be spent in eating. As it is, they can quickly fill their stomachs with grass in the intervals between flights from predatory beasts, and then retire to safety to chew at leisure.

The cow has a stomach divided into four compartments, not four stomachs as is often stated. The largest part is the *paunch*, into which the grass goes immediately, there to await a favourable time for chewing. The paunch is the storage-bag and no digestion takes place there (in the slaughtered animal tripe is made from the paunch). At chewing-time the grass is forced back into the mouth, and after mastication passes into the other stomachs, finishing in the fourth, where it is digested. Pigs and horses are not ruminants.

Note the teeth of a cow or sheep. There are no canine or tearing teeth, only biting and chewing teeth, as the cow is not a flesh-eater. Compare with teeth of dog or lion. The live cow gives milk, and from the dead cow we get meat, tallow, leather, glue (from hooves), and horn. Cows give milk only after they have calved; the young calves are weaned early and soon learn to take solid food.

Lambing-time may be spoken of. It takes place early in the year and is a busy time for the shepherd. Lambs are born in the open, but need some protection from draughts. If a lamb dies, the shepherd may tie its skin on to a lamb

whose mother has died. The mother of the dead lamb then suckles the orphan. Shearing is done as the weather gets warm. The skin of the sheep is used to make a soft leather for gloves and bags. Or it may be scraped and stretched and made into parchment. Mention use of parchment for drums and for lawyers' deeds (see also HISTORY, Volume II, "The Story of Paper"). The shepherd's dog should be mentioned and his activities described.

Horses today are perhaps of less interest to children than are motor-cars, but something should be known about this friend of man. Different breeds may be spoken of. The race-horse, descended from the Arab horses, and the heavy carthorse, the descendant of the warhorse of the Middle Ages. The teeth of a horse are similar to those of the cow, incisors and molars only.

A pig has canine teeth and can eat flesh as well as vegetable matter.

This lesson provides an opportunity of inculcating ideas about kindness to animals, the horse especially being a good subject to take. Compare the good and bad horse-owner. The good master attends to feeding and grooming, brushing and combing from the horse's coat sweat and dust, and massaging the legs. He does not overwork the horse, nor drive him with tight bearing reins, he rewards him with titbits for work well done. The vicious horse is usually one which has been ill-treated or frightened at some period of its life. The well-treated horse works well, and as a rule shows no vice. Children will be able to tell about horses they have seen or known.

Children's Activities

(1) New words learnt: arable, cloven, dew claws, canine, molar, ruminant, paunch, etc.

(2) Imagine you are spending a holiday on a farm. Describe all the things the farmer does from the time he gets up in the morning. First tell what sort of farm it is and the time of the year.

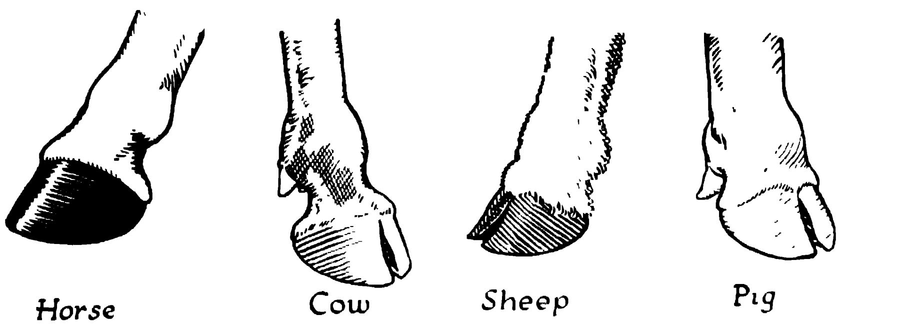
(3) Mention the things we get from the cow, the sheep, and the pig.

(4) If you want to know whether a certain animal is a vegetarian or a flesh-eater, where would you look, and why?

(5) Why are cows generally found near a farm, but sheep are often far away? Do cows and sheep like the same kind of grass? Notice where they feed. (You can often see them from train windows.)

(6) Find out more about sheep and cows in *What the World Eats* (Evans).

(7) In the English lesson the children may write a description of the



HOOVES OF FARM ANIMALS.

farm (Plate XX) and of some particular animal on the farm.

Milk

Required: bottle of milk, test-tubes, vinegar or dilute acid.

This should be looked upon as an important lesson or series of lessons which should aim at showing the great importance of milk as a food and also the dangers which may arise from the neglect of elementary laws of hygiene in the keeping and use of this food.

Why is milk supplied to school children every day? It is known that milk is one of the most nourishing of foods, and although as we grow older we should have solid food as well, milk contains all the things required for body-building and growth. Some milk from a shaken bottle is poured into a test-tube and allowed to stand in a cool place for several hours. The cream rises to the top and can be recognized by its colour. A finger dipped into the cream feels greasy when rubbed, for the cream is the fat of the milk. Fat is one essential part of our food.

The part that is left is called *skim milk,* and does not feel greasy. If the whole milk is left to stand in a burette instead of a test-tube, the skim milk may be run off from the tap and a better separation obtained than if the cream is poured off from a test-tube. A few drops of vinegar or a drop or two of any other dilute acid is poured into some skim milk. A thick clot or curd is formed. This is called *casein,* compare this with white of egg after boiling or poaching.

Both casein and white of egg belong to a class of foodstuffs called *proteins,* another necessary part of food. Lean meat, bread, beans, and lentils also contain proteins.

The watery liquid left above the clot of casein is called *whey* and contains milk-sugar, something like . ordinary sugar but not so sweet. Sugar is a necessary foodstuff. Remember Miss Muffet, eating her curds and whey. Was this a perfect food? What was lacking?

Milk contains all the kinds (three) of necessary food materials. We cannot say the same of meat or potatoes. With solid food we need several varieties in order to get all the kinds of foodstuffs we require.

If milk is a good food for us, it is also, unfortunately, a good food for other living things that may cause us harm. Some plants, like the mistletoe, steal their food from other plants. There are some very tiny forms of plant-life, visible only under a powerful microscope, that steal food from milk if given a chance. These are called *bacteria.* They do not look like ordinary plants, but like little round specks, or little rods, or like little curly bits of string. They may float in the air, rest on specks of dust, on hands and clothing and floors. Many are harmless, some turn milk sour, and some cause illness. People sometimes call them *microbes,* and the dangerous ones may be called *disease germs.*

Disease germs may get into our bodies by way of cuts and open wounds, or if we suck dirty fingers or objects that have rolled on the floor.. At one time milk was liable to contain many germs, for the cows were milked in dirty sheds with cobwebs and dust hanging from ceilings and walls; the milkers perhaps had dirty hands, and the milk was left to cool without being covered from dust. Hence the milk may have been teeming

with bacteria by the time it was delivered, and either went sour or possibly spread disease. Today clean milk is aimed at.

Louis Pasteur, a great French scientist, first found out about bacteria. He found that they thrive best in a warm temperature. Cold stops them from multiplying, but does not kill them. Great heat, however, kills them. A milk-jug or anything else left in boiling water for some time is freed from germs. It is said to be *sterilized*.

Boiling the milk would kill any germs, but boiling spoils the milk somewhat as a food. Pasteur discovered that if milk is heated to 63° C. (140° F.) for half an hour, all harmful bacteria are killed. The milk is said to be *pasteurized*. Most milk sold in towns today is pasteurized to make it safe. The best milk, however, is "certified" or Grade A (T.T.) and does not require pasteurizing. How is this produced?

The cows on a Grade A farm are tested periodically for tuberculosis. Only milk from a healthy cow is passed T.T. (tuberculin tested). The milk in a healthy cow is free from germs, and if it is kept so after milking, it will neither go sour nor carry disease. Hence the milking-shed is light and airy and is washed out by hose before the cows come in to be milked. All cows have hindquarters and underbelly clipped so that no hairs shall carry dirt. Before milking, hindquarters and udder are washed. The milkers have washed hands and wear white overalls and caps. Milking-pails have been steam sterilized and have covers to prevent dust from falling in the milk. The milker lets the first squirt of milk fall on the floor in case there are any bacteria in the end of the teat, then directs the rest of the milk into the pail through a side opening under the cover. With such cleanliness there will be few bacteria about, but as the milk is warm, any germs there may be would multiply quickly. Therefore the milk is poured at once through a strainer and over a cooler, whence it runs directly into sterilized bottles or churns.

In many modern farms the cows are now milked by machinery driven by an electric motor, and the milk goes direct from the cow to the cooler.

Care of Milk at Home

Place the bottle, unopened, in a cool place until needed. Before pouring the milk into a jug, rinse this out with tap-water, however clean the jug may be, to wash out any bacteria that may have settled in. Cover the jug with a saucer or muslin cover. Do not cough or breathe over the jug.

A further experiment can be done to show that clean milk remains sweet longer than unclean. Two test-tubes are sterilized by boiling, or in a hot oven, then plugged and left to cool. The plugging is done with cotton-wool which has been in a hot oven; each plug is lighted at a bunsen and pushed, still burning, into the mouth of the tube. When cool, each tube is filled with sterilized milk (sterilize by keeping just under boiling for half an hour). One tube is replugged and the other left open. The milk in the plugged tube should keep sweet for several days at least. The other will sour slowly or quickly according to weather and conditions.

Children's Activities

(1) New words learnt: casein, curd, proteins, bacteria, microbe, sterilize, pasteurize.

(2) In some countries the cows are milked out-of-doors. Can you think of some ways in which this may be a good thing and other ways in which it may be not so good?

(3) If you were doubtful about the cleanliness of some milk but did not want to waste it, what would you do to it before using it?

(4) Make a list of all the ways you can think of in which milk is used in making things to eat or drink.

(5) Tell the story of milk from the cow eating grass in the meadows to the bottle of milk on our doorstep.

(6) Find out more about milk for yourselves in *What the World Eats* (Evans Bros.). Here you will find pictures of cows being milked, etc.

II. Plant Life

Sprouting Seeds

Required: Gas jars with well-greased cover plates or fruit-preserving jars with airtight stoppers, small beakers, cotton-wool, lime-water, seed peas, mustard seed.

First recapitulate the work done on carbon dioxide and oxygen, so that the class will be aware of their properties and significance in Nature. Give children some mustard seeds to examine. They are dry and covered with a hard coat. Is there a baby plant in each seed? Why can it not get out? Perhaps because of the hard, dry coat. Would they sprout if the seeds were given some water? Try this: take two saucers with flannel or a layer of cotton-wool in the bottom, one saucer quite dry, the other with the pad well soaked in water. Scatter mustard seed on each and leave in a warm room. Let children examine them each day and keep reports. There is no change in the dry seeds, but the wet ones appear to be swollen and feel softer after twenty-four hours. Later a little white root will appear from each seed. Note how this bends over to touch the wet flannel. Then the husk splits and a slight stem carrying two white leaves appears. These turn green, and other leaves grow. Note the difference between the first (cotyledon) leaves and the others.

Deduce—seeds need moisture in order to sprout. Do they need anything else? Repeat the experiment, using peas instead of mustard, grown on a wet pad at the bottom of a closed gas jar. Put a small beaker or other glass vessel containing about three c.c.s of clear lime-water in the jar. The seeds soon sprout and their progress may be watched. After about ten days the lime-water will have clouded, showing the presence of carbon dioxide. Now take off the cover plate and plunge a lighted taper into the jar. The light is extinguished. When asked the reason, children may say because of the carbon dioxide present or because there is no oxygen left in the jar. In either case it should not be difficult to make them realize that sprouting seeds require air (oxygen), moisture, and warmth, and during sprouting give off carbon dioxide.

Hence we have three cases of oxygen being used up and carbon dioxide being produced: (*a*) a candle burning, (*b*) a person breathing, (*c*) a seed sprouting. If rusting is mentioned, it should be made clear that in this case oxygen is used but no carbon dioxide is made.

Ask why seeds do not sprout in winter, in dry ground, when buried too deeply. The word *germinate* may be given to the class. It has already been decided that breathing implies a form of combustion. But combustion pro-

duces heat; this is evident in the case of burning or rapid combustion, also in the case of breathing—body temperature kept up. Is sprouting accompanied by combustion? Is heat given out? Try this experiment. Soak a large quantity of barley or other cereal in water for a day. Put half the seed in boiling water for ten minutes, to prevent germination. Half fill two similar wide-mouthed bottles, one with boiled and the other with unboiled seed, after draining. Place a thermometer in each jar with the bulb well down in the seed mass. Plug the necks with cotton-wool round the thermometers. Wrap each bottle with several layers of newspaper to prevent loss or gain of heat from outside. Take daily, and later hourly, readings of the thermometers. The one in the germinating seeds will show higher readings than the other. A child may ask if rusting is a form of combustion. The answer, of course, will be in the affirmative, but the heat evolved is so small and is given out so slowly that an ordinary thermometer will not show it. A Beckmann thermometer in damp iron filings enclosed in a Dewar flask will show this, but few schools will possess such costly apparatus.

If any doubt is evident about seeds using up oxygen, the following experiment may be tried. A stick of caustic potash, loosely wrapped in wire gauze, is placed at the botttom of a wide-mouthed bottle, a quantity of soaked peas put in, and the bottle closed by a cork carrying a leading tube dipping into coloured water. The carbon dioxide produced is absorbed by the potash, and the water rises in the leading tube, showing that some of the air is used up. After a time the liquid stops rising and the peas stop sprouting—when all the oxygen in the air has been used. A lighted taper placed in the bottle is extinguished, showing absence of oxygen.

The Baby Plant in the Seed

Required: Gas jars or jam jars, blotting-paper, iodine solution, magnifying-glasses, seed beans.

Broad beans are suitable for this lesson, as they are large enough to be handled and examined. It is wise to be ready with specimens of germinating beans. These might be soaked for a day before sowing. A gas jar into which a roll of coloured blotting-paper has been dropped and pressed out to make a lining to the jar makes a good germinating case. One or two soaked beans are inserted between the glass and the paper lining, and the interior of the jar filled with sand or fibre, or even with sawdust or tissue paper. The filling is kept moist and supplies moisture to the seed. Several jars should be prepared at intervals, starting about a fortnight before the lesson, in order to ensure a set of specimens at the required stages. Black or brown paper should be wrapped round the jars to produce darkness, as would be the case with seed planted in soil. This can be taken off for examination, and the class can then see the stages of development of the baby plant.

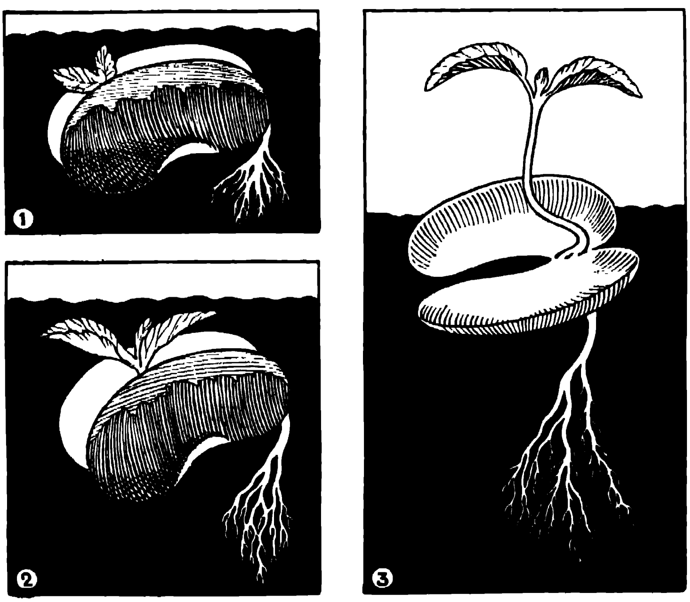
Give the class dry and soaked broad beans to examine, but first let them see the germinating beans. Show first some seeds just beginning to sprout; the little root appears first, looking like a small white tail. It may come from the underside or the upper side of the seed, but sooner or later it begins to bend over and grow downwards. Examine the root tip under a glass. It is covered with a sheath; this protects the tender

tip of the root as it pushes its way through the soil, and also (though we do not know why) makes the root tip grow downwards. If the root tip is cut off, the root shows no tendency to grow downwards.

Soaked haricot beans may be sown on the top of fine soil in a box and kept moist. Any roots coming from the top bend over and enter the soil (geotrophy).

Some of the more advanced seeds in the jars will show the branching rootlets. Where is the stem? This is probably picked out better in the box-grown seeds; it is the part above the soil, but in the early stages it is bent because its end remote from the root is still fixed to the bean. Later the stem gets stronger and stands erect, lifting the bean with it, but this now opens out to form two fleshy green leaves, called seed leaves or *cotyledons*. Still later the stem grows up beyond the cotyledons and other leaves appear, but these are of different appearance.

The explanation of these phenomena can come with an examination of the soaked beans. First note the scar at one end, where the bean was originally attached to the pod. Near this is a small hole. If the bean is squeezed, some water will ooze from the hole. Carefully peel off the skin from the bean; a sharp knife is required for this, and the teacher must either perform the operation for the children or be ready to deal with cut fingers. Under the skin is seen the tiny root, pointing towards the hole in the skin. Split the bean in halves. It separates easily into the two cotyledons, and the baby plant can be seen attached to one of them. The cotyledons are thicker and more fleshy than ordinary leaves, for they contain the food store laid up by the parent plant for the support of the young one until it is big enough to find and make its own food. By the time the cotyledons are erect on the stem much of this food store has been consumed, and the seed leaves in consequence are thinner. Later, when their usefulness is over, they will fall off.



A Bean Growing.

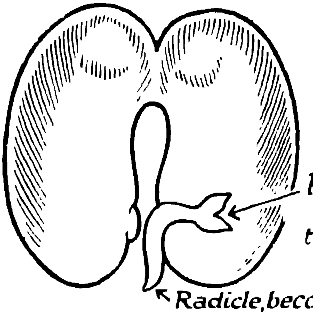
Many seeds have two cotyledons, and are known as *dicotyledons*. Others have only one, and are called *monocotyledons*. Cereals—wheat, oats, barley, etc., grass, lilies, and daffodils — are monocotyledons. Distribute grains of wheat for examination. Note the oval patch on one side at the bottom or broad end. This is the baby plant, and if the seed

has been soaked in water for a day, the baby plant can be lifted off with a penknife. The remaining part of the seed is the food store (endosperm). Try to germinate wheat in jars lined with blotting-paper. Note that the root, which soon divides, comes from the same place in the seed as the stem. If barley is sprouted, it will be seen that the stem pushes its way through the seed and emerges near the other end.

The baby plant in wheat is called the *germ*, and under a glass both root (radicle) and shoot (plumule) can be seen, also the one cotyledon leaf (saxtellium). Try to germinate the endosperm without the germ and the germ without the endosperm. Neither grows, the first because it is not a baby plant and the second because it has no food. Of what does the food consist? Show the test for starch. Add a drop of iodine solution to cold starch paste; a blue colour is produced. Show that if thick starch paste is touched with a rod dipped in iodine solution, the blue is so intense at the point of touch that it looks black. Try the same tests with the endosperm of wheat or the cotyledons of a bean; the presence of starch is revealed.

Give children grains of wheat or barley to chew. Then give them sprouted grains; they will say the sprouted grains taste sweeter. During germination the starch changes into sugar. Sugar is soluble, starch is not; plants live on soluble food.

The matter can be left here, but if any question arises about why starch changes to sugar, the teacher can say that during germination a substance is produced which is able to do this. Children may be told that another substance that can do this is saliva. If a child is given a piece of dry bread and



A GERMINATING BEAN.

told to chew it for five minutes without swallowing, the observation will be that it has become sweet. (The malting of barley is a case of germination in a warm place kept moist; an enzyme ferment converts the starch to sugar, and then germination is stopped by raising the temperature. The result is malted barley, ready for brewing. The agent in saliva that is able to change starch to sugar is called ptyalin.)

Children's Activities

(1) New words learnt: cotyledon, dicotyledon, monocotyledon, germinate.

(2) Try to sprout some soaked broad beans in glass jars lined with blotting-paper. Keep one jar in a cold place, one in a warm place exposed to light, and another in a warm place but shielded from the light by a wrapping of brown paper. Make notes of any differences in the results.

(3) Take a bean which has sprouted far enough for the rootlet to point downwards. Turn it upside down and leave it for some days to note what happens.

(4) Soak a small plant pot in water for several hours. Then turn it upside down in a saucer of water and scatter mustard or cress seeds all over the outside. Leave them to germinate.

(5) In a box of soil plant a row of broad beans, another of haricot beans, one of peas, one of cress, and one of lettuce. Notice which seeds sprout first. Note also in which cases the shoot appears first, and in which cases the root.

Seed Dispersal

This is an autumn lesson, and as many kinds of fruit and seed as possible should be gathered, preferably by the children themselves. They may be told some time before the lesson to begin their collections, making notes of how they think or have observed the fruits to have travelled from the parent plants to new positions. They should also be encouraged to find out for themselves, as far as possible, how each kind of seed is adapted by its construction or by its position on the parent plant for its particular method of locomotion.

If for any reason the lesson cannot be taken in the autumn, specimens of previously collected dry fruits and seeds may be distributed and the children asked to name them if possible, but in any case to draw their own conclusions as to how each type is fitted for travel. They should decide in each case whether they think any particular seed is usually wind-borne, water-borne, carried by birds or animals, or thrown off by some peculiar construction in the parent plant. Lists and drawings may be made, and then the findings of the children corrected and amplified by the teacher. The conclusions thus jointly arrived at would be as follows.

Plants must scatter their seeds to give them a chance of survival. Seeds which fall straight down may fall on dry soil under the shade of the parent plant, and even if they germinate will not be able to compete successfully for sunshine, air, and moisture, with the already established plants.

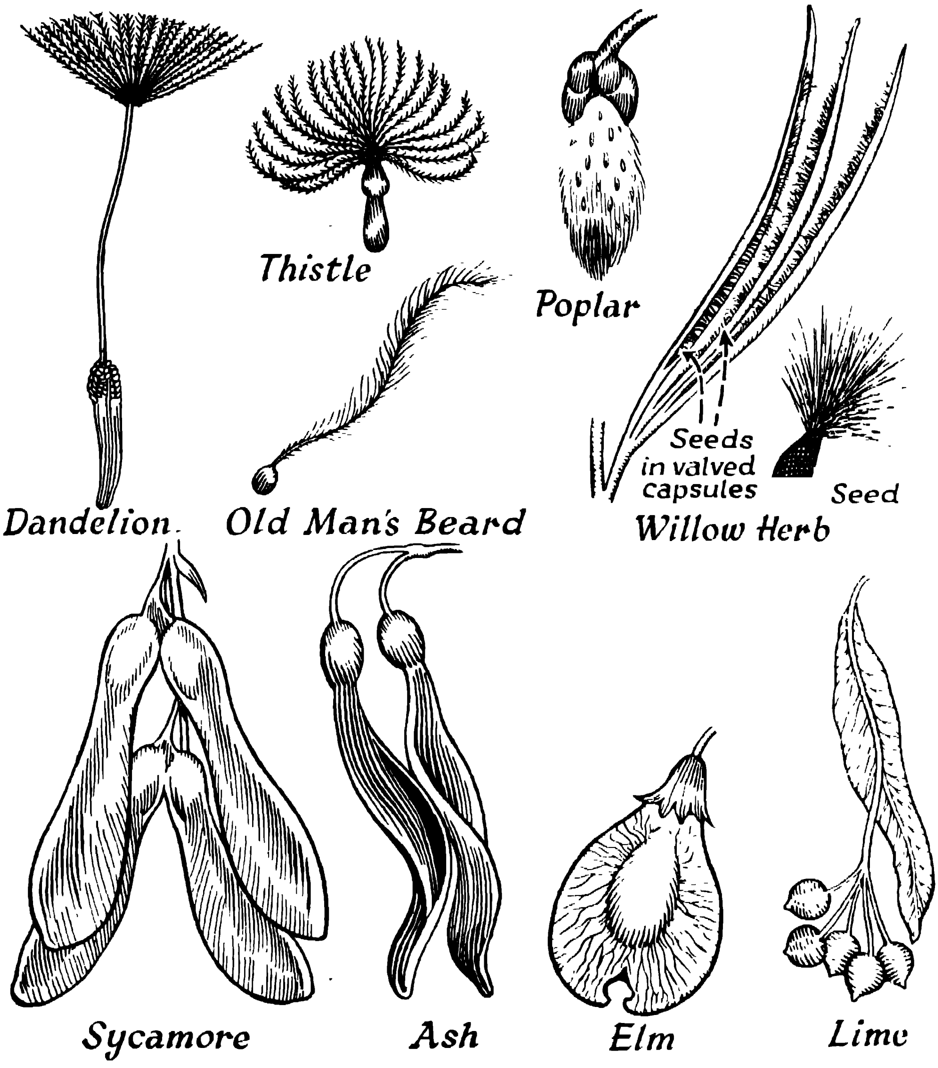
Seed dispersal is not so necessary in the case of annuals, which die off before the seedlings show, but it is obviously desirable for perennials.

1. *Wind-borne Seeds.* — Dandelion, thistle, old man's beard, poplar, willow and willow herb, goatsbeard, ragwort, cotton plant, have feathery or parachute-like fruits. Winged fruits of maple, sycamore, ash, elm, lime.

2. *Seeds carried by Birds.*—Soft fruits and berries, the seeds being either ejected uneaten or excreted after passing undigested through the alimentary canal, e.g. currants, cherries, berries of rowan, elder, holly, also rose hips.

3. *Seeds carried by Animals.*—Hooked fruits such as goose grass (cleavers) or little burrs, and burdock or large burrs. These all children will know as the burrs they throw at each other and which hook on to clothing. Also many seeds which fall to the ground may be carried away on the feet of animals.

4. *Catapult Fruits, or Seeds shot off from the Plant.*—Broom, yellow flowers rather like sweet pea, giving place to black pods covered with hair. When ripe the pod suddenly bursts open with a pop, the two halves curl up quickly, and the seeds are shot off to a distance of several feet. The gorse, vetch, and lupin act in a similar way. In the wild geranium the fine closely packed seed-boxes split open and curl up from the bottom, jerking out the seeds as they do so. The pansy and also the violet have seed-boxes which divide when ripe into three parts, open at the top. Then as these dry, the sides close up and the seeds are squeezed out and shot to a distance. In the fruits of the poppy



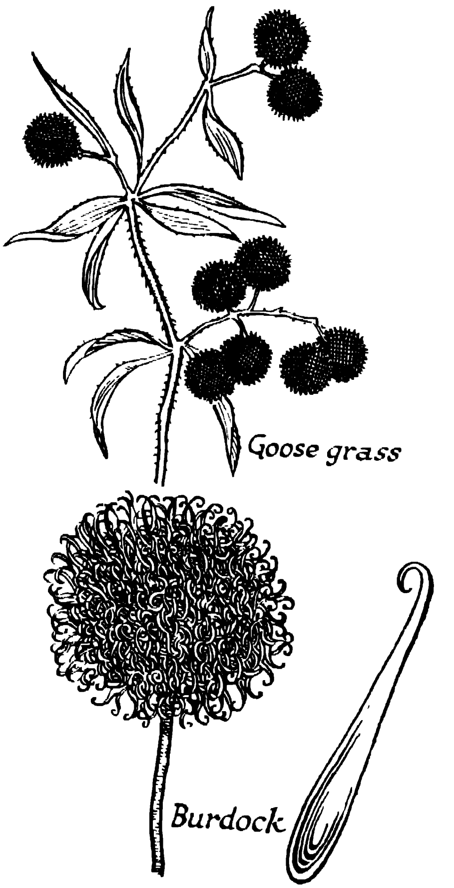
WIND-BORNE SEEDS.

(poppy head) there are little holes round the sides near the top, and as the plant sways in the wind the whippy stem of the plant causes seeds to be jerked from these holes.

5. *Water-borne Seeds.*—Many water plants or plants which grow at the water's edge have fruits which float and are not damaged by water, e.g. lily, alder, coconut.

Children's Activities

(1) Make a book of dried fruits and seeds; keep separate pages for seeds scattered in different ways, putting in the names and the way the seeds travel



SEEDS CARRIED BY ANIMALS.

(2) Name some birds or animals which help to spread seed of the following plants: mistletoe, cherry, rose, burdock.

(3) Most orchids have tiny seeds almost as fine and light as pollen. How would you expect these seeds to be carried?

Carbon Assimilation in Plants

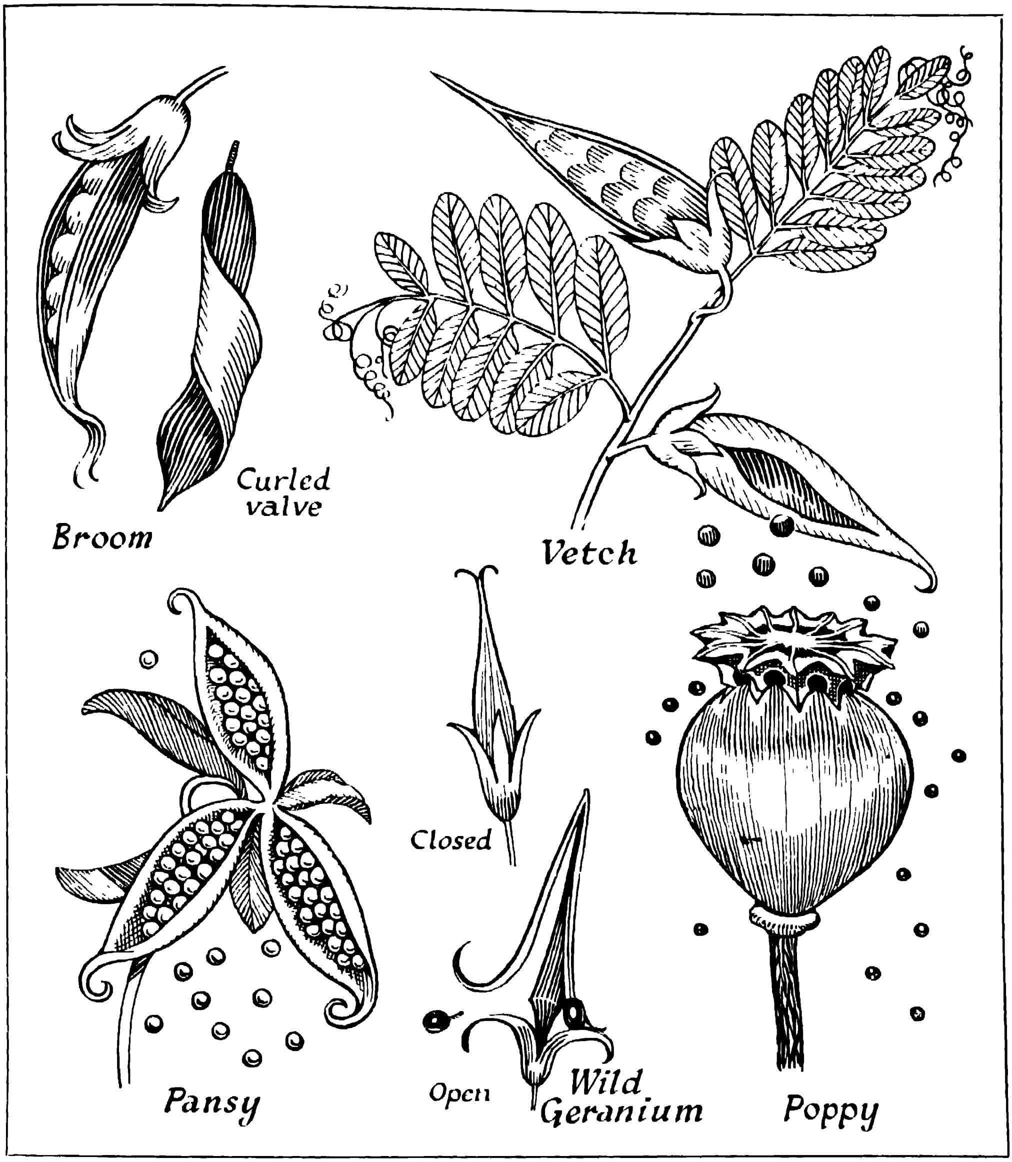
This lesson may be called " How the plants help to keep the air pure." It should follow, not precede, the lessons on burning and breathing.

Required: Iodine solution, beakers, water-bath, plant grown in darkness, leaves picked in sunlight and in early morning, leaves picked after being partly covered for a day with an opaque disc; pond weed, funnel, and test-tube.

Tell the story of Van Helmont's experiment. At Brussels, in the early seventeeth century, Van Helmont planted a willow tree weighing five pounds in a pot containing two hundred pounds of dry soil. During five years he gave it water only and watched its growth. The tree was then uprooted, and was found to weigh a hundred and sixty-nine pounds. The soil, when dried, weighed only two ounces less than at the time of planting. Asked for speculations as to where the material for the tree had come from, Van Helmont thought it all came from the water, but today we know more about the compositions of water and of wood, and we can show that Van Helmont was not entirely right.

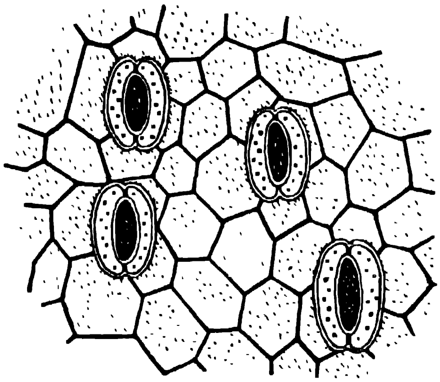
Show a picture of the stomata of a leaf, or allow children to look at a leaf under a microscope. Tell them that these tiny holes, sometimes wide open, sometimes nearly shut, communicate with the interior of the leaf. Some leaves may have as many as 100,000 stoma per square inch. Hold a leaf under water and blow down the stalk; notice the bubbles which appear on the leaf—proof of pores.

It will be necessary to tell children about starch and starch-making, as there is nothing in their experience to help them here. Talk about starch, where it comes from—rice, maize, flour, potatoes, plants in general. Starch is made of carbon, hydrogen, and oxygen. We cannot make it, but plants can. Portray the leaf as a starch factory, working by day and getting rid of its



Catapult Fruits or Seeds.

products at night. It takes carbon dioxide from the air via the stoma (or stomata), keeps the carbon and gives back the oxygen to the air. The hydrogen and oxygen come from the water sent up by the roots. Emphasize the wonderful nature of starch-making; the smallest green leaf does daily what our great chemists cannot do. But only green leaves can make starch. Mention *chlorophyll*, the substance which makes leaves green. It is only produced in sunlight; leaves grown in the dark are whitish in colour.



PORES OF LEAF VERY MUCH MAGNIFIED.

Remind children of the iodine test for starch, and demonstrate with starch paste. Now soak a leaf (geranium or nasturtium) in warm methylated spirit for ten minutes; beware of fire, heat the spirit in a beaker on a water-bath. Then wash the leaf in water and place in iodine solution. Note the deep blue, almost black colour.

Do the same with the leaf of a plant that has been grown in a dark cellar or at least kept in the dark until the leaves have lost their green colour; probably a fortnight or more will be necessary for this. Iodine produces no blue colour in this case. If large leaves are tested for starch, it is not necessary to submerge them in iodine solution; a few spots of solution dabbed on with a glass rod will show the effect, and the contrast between these and the undabbed part of the leaf will be more striking.

Repeat the experiment again with a green leaf which has been gathered in the early morning before sunrise and kept in the dark. Absence of blue colour shows that the leaf begins the day starch free. The same experiment is performed with a leaf on which a farthing, tiddlywink, or other opaque disc was placed at sunrise and held in position if necessary with a paper clip, the leaf being picked from the plant in late afternoon. This time the absence of starch in the part covered by the disc is shown.

Now sum up. Green leaves in sunlight contain starch. If no green colour, no starch is made. If no sunlight, no starch is made. Green leaves contain starch at the end of the day but not at the end of the night. Evidently leaves get rid of their starch during the night. Why and how? Ask what would happen in a bakery if the baker went on making loaves and never sent any out for delivery. During the night the leaf starch-factory closes down and delivery commences. The starch is delivered to other parts of the plant—roots, stem, branches, or fruit.

The teacher may decide not to elaborate on the method of starch-removal from the leaf, and there is wisdom in this. Briefly the method is as follows. During darkness the insoluble starch turns into sugar which dissolves in the sap-water and is transported to other parts of the plant, where it is changed again into starch, cellulose, or other material according to the needs of the particular part of the plant. A leaf gathered in sunlight and left all night with its petiole (stalk) in water gives the starch reaction next morning, for there is nowhere for the starch to go.

Return now to the fact that green leaves take in carbon dioxide, keep the carbon, and give off the oxygen. Place a quantity of American pond weed or watercress in water under a large funnel with a test-tube full of water inverted over the stem of the funnel. Place the apparatus in bright sunlight and note

the bubbles of gas given off. If a sufficient quantity of gas is collected, it may be tested for oxygen with a glowing splint. A second plant kept in the dark produces no gas, but if brought into the sunlight the liberation of oxygen commences.

People, animals, fires, etc., give off carbon dioxide to the air and deprive it of oxygen. Plants do the opposite, so the proportions of oxygen (20%) and carbon dioxide (0·03%) in air remain constant.

Plants also breathe as we do to some extent, but the amount of oxygen they use is small. The usual hospital routine of removing plants and flowers from the wards at night has little effect on the air of the wards. It is true that plants produce carbon dioxide and no oxygen at night, but the oxygen they use and the carbon dioxide they give out is so small as to be negligible. A nurse walking through the ward uses more oxygen than many bowls of roses.

The carbon and the oxygen cycle in Nature may be spoken of, but will make little impression on children of this age. Carbon and oxygen are not yet much more than names to them, and they have not sufficient understanding of chemical combination to enable them to appreciate the full meaning of the cycles.

Children's Activities

(1) New words learnt: stoma or stomata, chlorophyll, iodine, etc.

(2) How could you find out if there is any starch in potatoes or in rice pudding?

(3) Most leaves are flat and thin. Can you think why this fits them better for the work they have to do than if they were thick and round?

Plant Parasites

This lesson may be called "Robber plants."

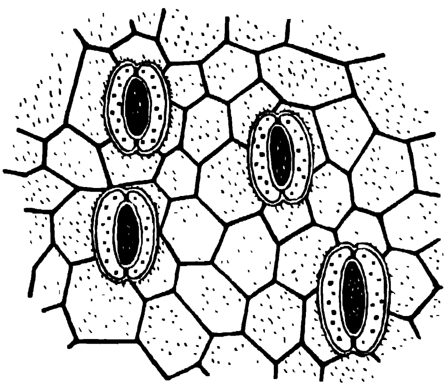
Required: Mistletoe, clover or heather entwined with dodder, toadstools or mushrooms, bread, cheese, jam, or leather with fungus, magnifying-glass.

Talk about the busy life of the average plant: the roots stretching out in all directions to search the ground for moisture and nourishment, and the leaves busily making starch by day and the sap distributing the food by night. Could a plant live for long without roots or without leaves? Are both necessary for food-making?

There are some people who try to avoid working for a living; they beg, borrow, or steal from those who work. Some plants are like this.

Show a piece of mistletoe; where does it grow? High up on the branches of apple, poplar, and certain other trees, less often on oak trees. The popular idea that mistletoe grows always on oaks may have arisen because of the legend that mistletoe from the oak was a sacred emblem with the Druids. Mistletoe never grows with its roots in the ground. Its leaves are small and not adapted to much starch-making. They are pale green and do not contain much chlorophyll. Evidently the mistletoe is not a worker. What roots it possesses have pierced the branch of the tree to steal the food made by the work of the tree's roots and leaves. Only in winter, when the tree is bare, does the mistletoe make a little starch, never enough to feed it for the whole year. Crush a mistletoe berry in the fingers and look for the seeds. Note the stickiness of the juice.

The missel-thrush feeds on the berries and then wipes its sticky beak on a



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There are some people who try to avoid working for a living; they beg, borrow, or steal from those who work. Some plants are like this.

Show a piece of mistletoe; where does it grow? High up on the branches of apple, poplar, and certain other trees, less often on oak trees. The popular idea that mistletoe grows always on oaks may have arisen because of the legend that mistletoe from the oak was a sacred emblem with the Druids. Mistletoe never grows with its roots in the ground. Its leaves are small and not adapted to much starch-making. They are pale green and do not contain much chlorophyll. Evidently the mistletoe is not a worker. What roots it possesses have pierced the branch of the tree to steal the food made by the work of the tree's roots and leaves. Only in winter, when the tree is bare, does the mistletoe make a little starch, never enough to feed it for the whole year. Crush a mistletoe berry in the fingers and look for the seeds. Note the stickiness of the juice.

The missel-thrush feeds on the berries and then wipes its sticky beak on a

SEEDS CARRIED BY ANIMALS.

(2) Name some birds or animals which help to spread seed of the following plants: mistletoe, cherry, rose, burdock.

(3) Most orchids have tiny seeds almost as fine and light as pollen. How would you expect these seeds to be carried?

Carbon Assimilation in Plants

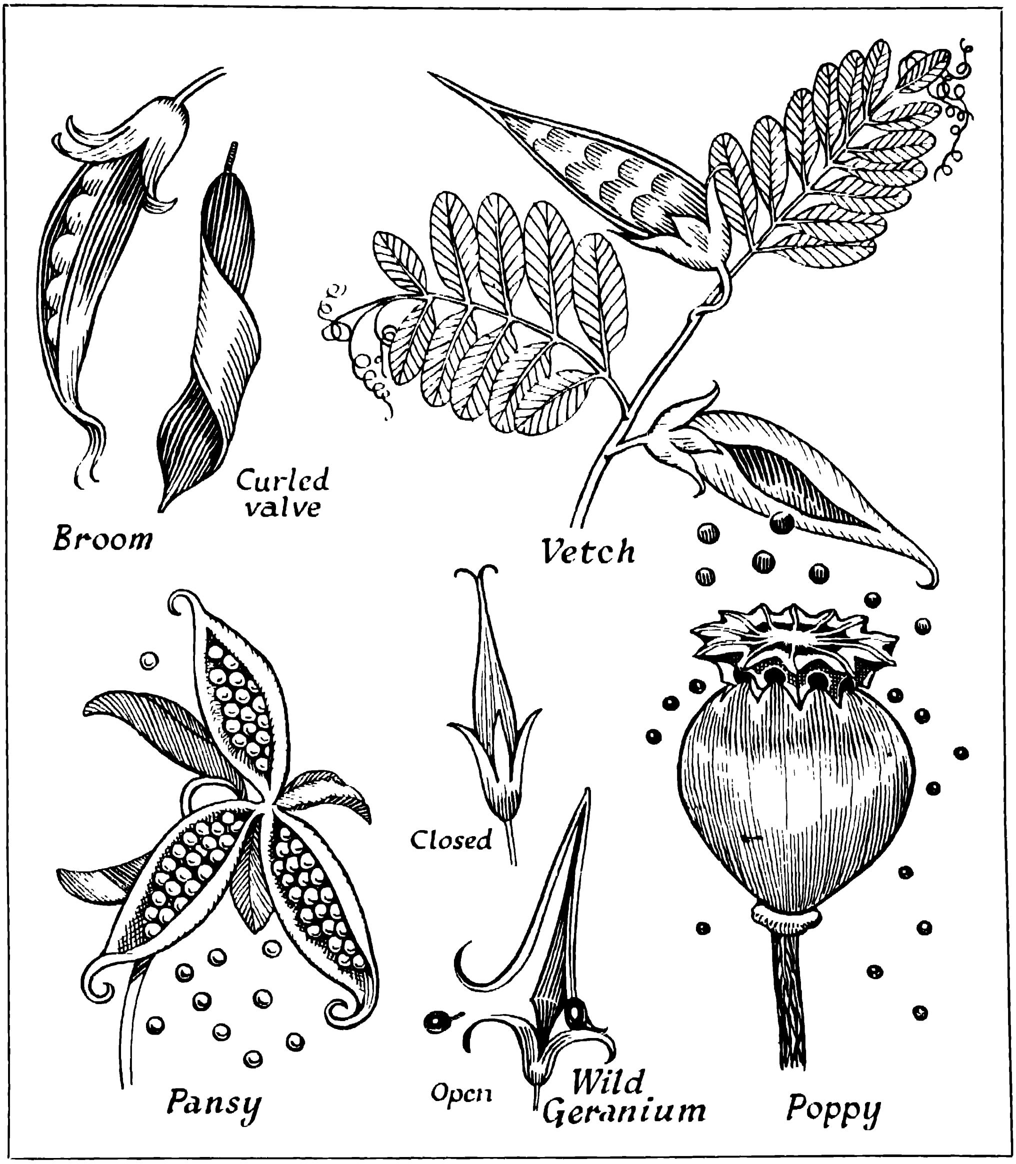
This lesson may be called " How the plants help to keep the air pure." It should follow, not precede, the lessons on burning and breathing.

Required: Iodine solution, beakers, water-bath, plant grown in darkness, leaves picked in sunlight and in early morning, leaves picked after being partly covered for a day with an opaque disc; pond weed, funnel, and test-tube.

Tell the story of Van Helmont's experiment. At Brussels, in the early seventeeth century, Van Helmont planted a willow tree weighing five pounds in a pot containing two hundred pounds of dry soil. During five years he gave it water only and watched its growth. The tree was then uprooted, and was found to weigh a hundred and sixty-nine pounds. The soil, when dried, weighed only two ounces less than at the time of planting. Asked for speculations as to where the material for the tree had come from, Van Helmont thought it all came from the water, but today we know more about the compositions of water and of wood, and we can show that Van Helmont was not entirely right.

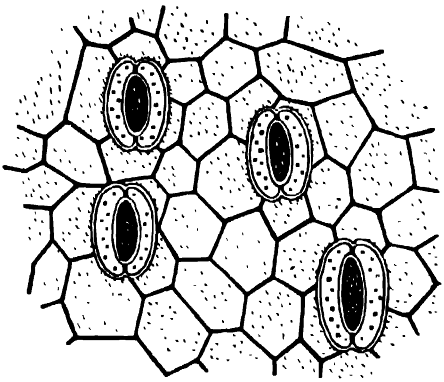
Show a picture of the stomata of a leaf, or allow children to look at a leaf under a microscope. Tell them that these tiny holes, sometimes wide open, sometimes nearly shut, communicate with the interior of the leaf. Some leaves may have as many as 100,000 stoma per square inch. Hold a leaf under water and blow down the stalk; notice the bubbles which appear on the leaf—proof of pores.

It will be necessary to tell children about starch and starch-making, as there is nothing in their experience to help them here. Talk about starch, where it comes from—rice, maize, flour, potatoes, plants in general. Starch is made of carbon, hydrogen, and oxygen. We cannot make it, but plants can. Portray the leaf as a starch factory, working by day and getting rid of its



CATAPULT FRUITS OR SEEDS.

products at night. It takes carbon dioxide from the air via the stoma (or stomata), keeps the carbon and gives back the oxygen to the air. The hydrogen and oxygen come from the water sent up by the roots. Emphasize the wonderful nature of starch-making; the smallest green leaf does daily what our great chemists cannot do. But only green leaves can make starch. Mention *chlorophyll,* the substance which makes leaves green. It is only produced in sunlight; leaves grown in the dark are whitish in colour.



Pores of Leaf very much magnified.

Remind children of the iodine test for starch, and demonstrate with starch paste. Now soak a leaf (geranium or nasturtium) in warm methylated spirit for ten minutes; beware of fire, heat the spirit in a beaker on a water-bath. Then wash the leaf in water and place in iodine solution. Note the deep blue, almost black colour.

Do the same with the leaf of a plant that has been grown in a dark cellar or at least kept in the dark until the leaves have lost their green colour; probably a fortnight or more will be necessary for this. Iodine produces no blue colour in this case. If large leaves are tested for starch, it is not necessary to submerge them in iodine solution; a few spots of solution dabbed on with a glass rod will show the effect, and the contrast between these and the undabbed part of the leaf will be more striking.

Repeat the experiment again with a green leaf which has been gathered in the early morning before sunrise and kept in the dark. Absence of blue colour shows that the leaf begins the day starch free. The same experiment is performed with a leaf on which a farthing, tiddlywink, or other opaque disc was placed at sunrise and held in position if necessary with a paper clip, the leaf being picked from the plant in late afternoon. This time the absence of starch in the part covered by the disc is shown.

Now sum up. Green leaves in sunlight contain starch. If no green colour, no starch is made. If no sunlight, no starch is made. Green leaves contain starch at the end of the day but not at the end of the night. Evidently leaves get rid of their starch during the night. Why and how? Ask what would happen in a bakery if the baker went on making loaves and never sent any out for delivery. During the night the leaf starch-factory closes down and delivery commences. The starch is delivered to other parts of the plant—roots, stem, branches, or fruit.

The teacher may decide not to elaborate on the method of starch-removal from the leaf, and there is wisdom in this. Briefly the method is as follows. During darkness the insoluble starch turns into sugar which dissolves in the sap-water and is transported to other parts of the plant, where it is changed again into starch, cellulose, or other material according to the needs of the particular part of the plant. A leaf gathered in sunlight and left all night with its petiole (stalk) in water gives the starch reaction next morning, for there is nowhere for the starch to go.

Return now to the fact that green leaves take in carbon dioxide, keep the carbon, and give off the oxygen. Place a quantity of American pond weed or watercress in water under a large funnel with a test-tube full of water inverted over the stem of the funnel. Place the apparatus in bright sunlight and note

the bubbles of gas given off. If a sufficient quantity of gas is collected, it may be tested for oxygen with a glowing splint. A second plant kept in the dark produces no gas, but if brought into the sunlight the liberation of oxygen commences.

People, animals, fires, etc., give off carbon dioxide to the air and deprive it of oxygen. Plants do the opposite, so the proportions of oxygen (20%) and carbon dioxide (0·03%) in air remain constant.

Plants also breathe as we do to some extent, but the amount of oxygen they use is small. The usual hospital routine of removing plants and flowers from the wards at night has little effect on the air of the wards. It is true that plants produce carbon dioxide and no oxygen at night, but the oxygen they use and the carbon dioxide they give out is so small as to be negligible. A nurse walking through the ward uses more oxygen than many bowls of roses.

The carbon and the oxygen cycle in Nature may be spoken of, but will make little impression on children of this age. Carbon and oxygen are not yet much more than names to them, and they have not sufficient understanding of chemical combination to enable them to appreciate the full meaning of the cycles.

Children's Activities

(1) New words learnt: stoma or stomata, chlorophyll, iodine, etc.

(2) How could you find out if there is any starch in potatoes or in rice pudding?

(3) Most leaves are flat and thin. Can you think why this fits them better for the work they have to do than if they were thick and round?

Plant Parasites

This lesson may be called "Robber plants."

Required: Mistletoe, clover or heather entwined with dodder, toadstools or mushrooms, bread, cheese, jam, or leather with fungus, magnifying-glass.

Talk about the busy life of the average plant: the roots stretching out in all directions to search the ground for moisture and nourishment, and the leaves busily making starch by day and the sap distributing the food by night. Could a plant live for long without roots or without leaves? Are both necessary for food-making?

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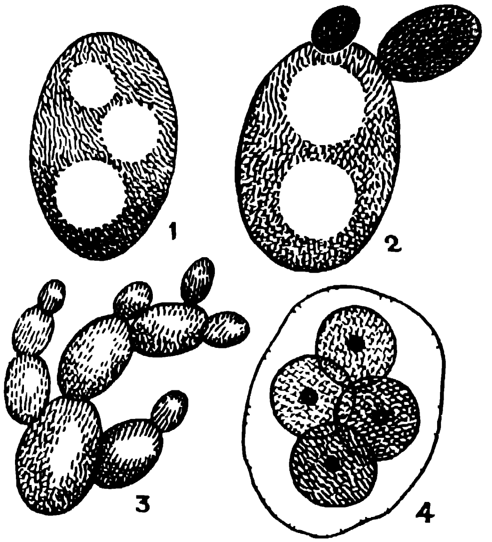


THE GROWTH OF YEAST CELLS, GREATLY MAGNIFIED.

branch. Perhaps a seed sticks to the branch, and when it germinates its roots enter the branch to steal its food.

Plants like the mistletoe are called *parasites.* Another parasite is the dodder, which has no green leaves at all. It twines itself round other plants and takes their food. At first it grows from a root, but when mature the root withers and the dodder lives entirely on its host plant. As one host dies the dodder straggles on to another plant.

Explain the meaning of *host*, in this case an unwilling one.

Some plants steal their food from dead plants and are called *saprophytes.* Toadstools and mushrooms are examples. They feed on the dead plants on the ground, or on manure. Some toadstool-like plants may be seen on dead wood. A plant of the toadstool kind is called a *fungus;* plural, *fungi.*

The business part of the toadstool is underground amongst the dead matter, and consists of long, slender threads called *mycelium.* The part we see above ground is the reproductive part, and when ripe tiny specks called *spores* fall from the gills situated on the underside of the umbrella part. These float away and may germinate to form new plants.

Mildew, which grows on bread, jam, etc., is a smaller type of fungus. Examine some mildew under the glass and note the mycelium. This is typical of fungi of this type. Propagation is by spores, as in the case of the toadstool. Spores of many kinds of moulds may float about in the air, and if they settle on bread, cheese, jam, etc., may develop into mould or mildew. Mention may be made of the new antiseptic drug *penicillin*, which is extracted from a kind of fungus. Note that all these moulds grow on dead matter.

Yeast is also a saprophyte plant. It has neither roots nor leaves. A magnifying-glass is not powerful enough to show the nature of yeast, but under a microscope it is seen to consist of a number of tiny oval cells. Each cell may be considered as a separate plant. Having neither root nor leaves, it cannot get its food in the usual plant manner, but simply soaks it up. The yeast cell does not grow bigger all over, but develops a swelling at one end. This swelling gets gradually bigger and at last, when it is about as big as the parent cell, it breaks away to form a new cell.

Children will like to speculate on the multiplying reproduction of yeast, one cell becoming two, two becoming four, etc. The yeast cell feeds on the flour of the dough into which the baker mixes it. As it feeds, the flour decomposes and carbon dioxide gas is given off. This, escaping through the dough, makes it porous, and consequently produces light, porous bread. The heat of the

baking subsequently kills the yeast left in the dough. If yeast dries up or gets no food, some of the cells may turn into spores which may remain dormant until conditions of food, warmth, and moisture make feeling and growth again possible.

Children's Activities

(1) New words learnt: parasite, saprophyte, host, fungus, mycelium, spore, mildew, mould, penicillin.

(2) Make a list of all the plants you know which steal their food from living plants, and another list of those which steal from dead matter. Do you remember the name of any insect that is a parasite?

(3) If a single yeast cell takes half an hour to become two, how long will it take for one cell to develop into 128 cells?

(4) Draw a yeast cell several times to show how it develops into two cells.

III. Related Science

This part of the syllabus should be given greater prominence than in previous years. Further progress in Nature Study requires an understanding of the fundamental principles of physical science and an elementary acquaintance with one or two simple chemical phenomena. The lessons can be made interesting, as they lend themselves to experiment and demonstration, and are all closely related to the everyday experiences of the children.

As many links as possible should be made between this part of the syllabus and the portion relating to living things.

HEAT (expansion and contraction)

Required: Collodion balloon, small tin can (bottle-shaped), flask fitted with stopper and long glass tube, beaker, sawdust or permanganate of potash, Gravesande's ball and ring or other apparatus to show expansion.

The nature of heat should not be discussed, as the idea of heat being a form of energy is too advanced for children of this age. There is no harm in asking how we obtain heat. Such answers as "from the sun," "by burning things," "electricity," "friction" may be accepted.

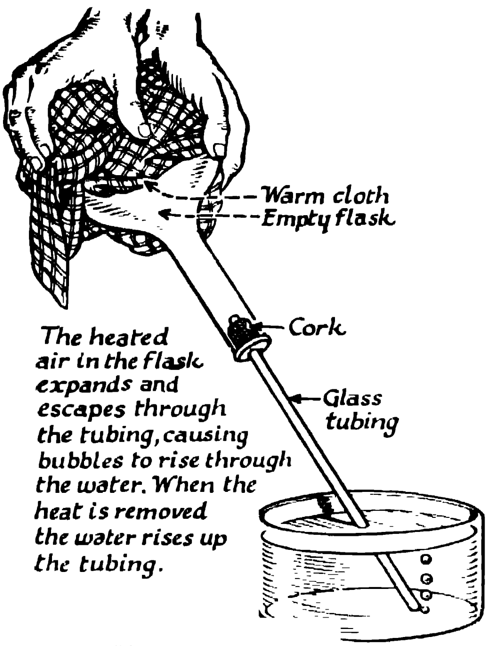
The next question is, "What can heat do?" This will probably produce such answers as "cooking things," "melting things," "making things bigger." It is the last of these effects of heat that should be studied.

Attach the neck of the balloon (deflated) to the neck of the tin can. Warm the can gently with a bunsen, taking care not to melt the solder. The balloon is inflated. Why? Only the air in the can is able to get into the balloon, so the air in the can must have got bigger when it was heated. Introduce the word *expansion.*

While the can is still warm, detach the balloon and, after deflating it, fit the neck once more over the can. Allow the can to cool, or cool it quickly by placing up to the neck in cold water. The body of the empty balloon is sucked into the can. Now use the term *contraction.*

Show a flask fitted with the cork and narrow glass tube. Place the end of the tube in a beaker of water, and on warming the flask with the hands bubbles of air are expelled and later, as the flask cools, water rises in the tube.

Fill the same flask with coloured water, using red ink or a soluble dye, so that the liquid level shows in the tube above the cork. Heat the flask on wire gauze over a bunsen and note the



HEAT CAUSES AIR TO EXPAND.

rise of water in the tube. An alternative to this experiment is to plunge the flask into hot water. Some children will notice that the level first falls, as the flask, first receiving the heat, expands, but almost immediately afterwards the liquid rises again, showing that the water now expands more quickly than the flask.

In the absence of any of the standard apparatus to show expansion of solids, use a large doorkey with a hollow barrel into which a carefully chosen nail just fits. On heating the nail, it becomes too large to enter the barrel. Or stretch a thin wire between two uprights, and on heating the wire show that it gets longer and sags. There should be no difficulty in establishing that things expand when heated and contract when cooled. Liquids expand more than solids, and gases more than liquids.

Ask for examples of this from everyday life. For example, railway lines have gaps between the ends and are held in position with sliding bolts. The tubular bridge over the Menai Straits is fixed at one end and rests on rollers at the other. Telegraph wires sag in summer and are more taut in winter. After a fire in a steel-frame building, the girders may be found to be bent, the fixed ends giving no room for expansion. The wheelwright heats the iron tyre and shrinks it on to the wooden wheel. A glass stopper stuck in a bottle may be loosened by heating the neck of the bottle. A kettle filled to the brim drips as the water gets hot. A bicycle tyre may burst when heated by the sun. Many other examples will occur both to scholars and teachers. It should not be difficult to introduce also the subject of convection in fluids. Warm air rises, and so does hot water. Mention draughts of cold air coming under the door to replace the hot air which goes up the chimney or towards the ceiling.

A single crystal of potassium permanganate dropped to the bottom of a large flask or beaker of water will show the convection currents when the vessel is heated by a small flame. A similar result, though less striking, may be obtained by sprinkling powdered chalk or sawdust on the top of the water.

The model hot-water apparatus described on page 154 may be shown, and much time may be spent in describing the hot-water system of a house. Reference may be made also to radiators and hot-water pipes in the schoolroom.

Note that in the house hot-water system the hot water rises up the pipe leading from the *top* of the boiler and

the cold-water pipe enters at the *bottom*. Also the hot water enters the supply cylinder at the top, so as to avoid mixing with the cold at the bottom. The heating engineer calls this " obtaining good stratification."

Suggest to children that they examine their hot-water system at home and touch the hot-water tank at different times to find out which part of the tank first receives the hot water. Mention also the gas jet sometimes used in large halls for assisting ventilation. The jet is near the ceiling under a vent pipe, and the heated air rises up the pipe, thus causing fresh air to enter the room.

Another thing that may be mentioned is the effect of pouring hot liquids into thick glass or stoneware vessels. The inside tries to expand while the outside is still cool, a strain is caused and the vessel cracks. Thin glass is less liable to crack because the outside heats nearly as quickly as the inside. Heat-resisting glass, such as Pyrex, is specially made glass which shows practically no expansion. If a silica crucible or evaporating dish is available, this may be made red-hot and plunged at once into cold water without damage, as silica has practically no coefficient of expansion. Invar steel, used for clock pendulums, is another example of a product specially made which neither expands nor contracts.

Children's Activities

(1) New words learnt: expansion, convection, etc.

(2) Railway lines are laid with gaps between the ends, but tramlines are continuous. What can you say about this? (For the teacher: railway lines are entirely above ground and are subject to wider temperature changes than tramlines, which are embedded in the road. Tramlines, however, do show some distortion, but this is not so serious for a slowly-moving tram as it would be for an express train.)

(3) If things did not expand when heated, what difference do you think it would make to our everyday life?

THE EXPANSION OF WATER ON FREEZING, or why water-pipes burst in frost.

Required: Blocks of ice, heavy weight, strong wire; bottle with screw stopper or wired cork.

This lesson goes best in frosty weather, but if ice can be obtained or if a refrigerator is available, frost need not be waited for. Begin with a talk about burst pipes. Probably many children will say it is the thaw that does the bursting, and one object of the lesson will be to disprove this. A bottle is filled with water, the stopper screwed in or wired on, and placed in a refrigerator or left out on a frosty night. As this entails a long wait, it is as well to ask the question about burst pipes at the end of the previous lesson; prepare the bottle and promise to freeze the water in time for the next lesson.

The lesson may then begin by exhibition of the fractured bottle, still full of ice, with some ice issuing from the crack. This should dispose of the idea that the bursting of pipes is due to thaw. Water expands when it freezes. It is not necessary to talk about the maximum density of water, but the teacher will bear in mind the fact that water, in cooling, contracts until it reaches 39° F. (4° C.), then steadily expands until it freezes, when it suddenly expands still further. The ice formed then slowly contracts as it cools.

Mention the usual precautions to be

taken against frost. Turn off the water at the main stop-tap when a heavy frost is anticipated, then drain the house pipes as far as possible by opening the service taps. The wrapping of pipes with non-conducting material is a precaution which should, of course, be taken before the cold weather comes.

Next mention some of the natural results of the expansion of water on freezing. A garden roughly dug in autumn shows large clods of soil. The rain soaks into the pores of the clods, and on freezing in winter breaks open the clods. Note that the breaks are not noticed until the thaw comes, for the solid ice holds the soil particles together. The soil powders only after the ice has melted. This reminds us of the fact that burst pipes are not noticed until the thaw comes and the solid ice in the broken pipe turns to water and begins to leak away. Similarly rocks are broken up by the freezing of water in cracks. Remind the class that this is one of the ways in which the rocks slowly disintegrate into soil. Put a piece of ice in water to show that it floats. Ice is lighter (less dense) than water. Point out the small proportion of ice that is above water. When a pond freezes, the ice floats on the water. If it sank to the bottom, more water would then freeze at the top and sink also until at last the whole pond became solid ice. As it is, there is always plenty of room below the ice for fishes and other creatures to continue their usual activities. Actually, although this need not be mentioned to the class, the water at the bottom of all except very shallow ponds does not cool below 4° C.

Now talk about icebergs and their danger to shipping. About eight-ninths of an iceberg is below the surface. Where do icebergs come from? The usual regelation experiment may be done, but it is doubtful if children ever fully appreciate its significance. However, it is thrilling to watch, and some children may understand it.

A strong wire carrying a heavy weight is looped round a block of ice supported across two stools. The wire slowly sinks through the ice, and when the weight has pulled the wire through the block still remains whole. With a block six inches thick each way and a weight of about fifty pounds, the wire will come through usually in less than an hour. With a smaller weight the time is longer. This shows that ice is melted by pressure. As the wire sinks, the water above, relieved of the pressure, freezes again. Children will know that when a snowball is squeezed it feels wet, but when the squeezing has stopped it is more solid than before.

Talk now about a *glacier*. The snow on high mountains piles up, but is never warm enough to melt. The weight of the snow at last melts the part near the rock and the mass begins to slide down. Thus a kind of river of ice is formed which slides slowly down, taking with it stones and pieces of rock scratched off the mountain-side. When the glacier comes down to warmer regions, it melts and forms a river. Show pictures of glaciers and mention the Rhône, which is the result of the melting of the Mer de Glace.

A glacier moves too slowly for its motion to be seen. Sir John Tyndall, Director of the Royal Institution 1867–1887, drove a row of sticks into a glacier across its course, the outer sticks of the row being on solid snow. A year afterwards he found that the sticks on the glacier were some distance lower down.

GLACIER

He was thus able to measure the speed at which the glacier travelled. He found that the centre of the Mer de Glace travelled thirty inches a day in summer and about fifteen inches in winter.

If a glacier flows over a precipice, it cracks and forms a crevasse. Lower down the crack may close up and freeze together. Objects dropped into a crevasse may sometimes be recovered many years later when that part of the glacier reaches the warmer valley and melts.

In polar regions glaciers do not melt, but pieces break off the ends as these reach the sea. These pieces are the icebergs which travel to warmer regions, carrying their cargo of stones, etc. When they melt, the stones are deposited. The fishing-banks of Newfoundland have been formed in this way.

Children's Activities

(1) New words learnt: glacier, crevasse, etc.

(2) Can you think of any other results, not talked about in the lesson, due to water expanding when it freezes?

(3) The Mer de Glace has been mentioned in this lesson. What does " Mer de Glace " mean? Try to find it in an atlas, and then find out where the river it makes reaches the sea.

(4) Why does a motorist empty his radiator if he is going to leave his car outside on a frosty night?

(5) Where is the stop-tap in your house?

Light

Required: Optical lantern or bicycle lamp, sheets of coloured glass or Cellophane, Newton's disc (Plate XXI), pinhole camera, candle, bunsen, incandescent mantle or blowpipe and piece of quicklime, glass prisms, model or picture of eye.

As was the case with heat, no definition of light should be asked for.

What things give us light? The sun, fire, matches, candles, lamps, gas-burners, electric lamps, etc. The stars may also be mentioned, but if the moon is given as a source of light, children must be reminded that the moon gives no light of her own, but only reflected light from the sun. It will be evident that all the light-givers in the list are hot whilst they are giving light. Do all hot bodies give out light? Discuss such things as hot-water pipes, hot potatoes, etc. Would such things give out light in a dark room? A red-hot poker may be thought of; it gives out some light, but not much. Some children may, however, have seen molten iron running from a blast furnace, or a white-hot piece of metal in a foundry or blacksmith's shop. These things give out light, but they are known to be very hot. If an oxyhydrogen blowpipe jet from an optical lantern is available, a piece of quicklime may be heated until it gives out a brilliant light. Or an ordinary incandescent mantle may be held in the flame of a bunsen.

Any body will give out light if it is hot enough. Some things must be made very hot for this to happen, but others, as for example the gas mantle, need not be very hot.

A body hot enough to give out light is said to be incandescent. Note that an incandescent body is not necessarily burning, as for example the filament of an electric bulb or the gas mantle.

The teacher may like to digress here and give an historical survey of the improvements in artificial lighting. Early man had no artificial light until he learnt to make a fire. Thus he could only move and work in the day-time and could not venture far into dark caves or similar places. Hence his fear of the dark. Even with a brand from his fire he could not explore very far, for once the brand had burnt out he had no means of relighting it. It will be very revealing to children to summarize the things we can do today compared with what was possible to primitive man or even to people of the

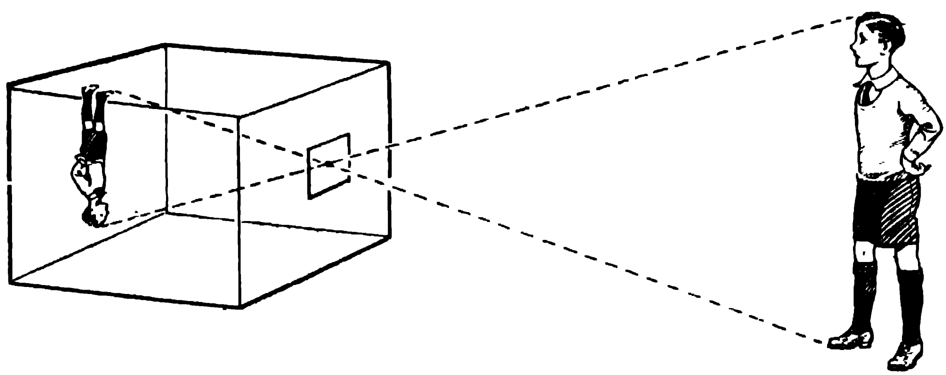
Middle Ages. Torches, candles, lamps, flint and steel, fishtail gas-burners, incandescent gas, and electric lighting may all be discussed in a general review of lighting progress.

If the classroom can be made dark, demonstrations may be given of earlier forms of lighting so far as these are available. A candle on the teacher's desk will not light up much of the room. A bunsen burner in a dark room scarcely shows, but if a gas mantle is held in the flame the result is impressive.

Earlier lessons and subsequent experiences have given the children some general ideas about the elementary facts of light. They know that light travels in straight lines, passes through transparent objects and is impeded by opaque objects. Also that objects such as chairs, tables, etc., which give out no light of their own, are visible only when light falls on them and is reflected to the eye of the viewer. Light itself is invisible, but the track of a beam of light can be seen by the dust particles lighted up in its path. These facts should be revised and then extended.

A pinhole camera may be shown and children encouraged to make their own. As is evident in the diagram, they will be able to see that it depends on the fact that light travels in straight lines, hence the inversion of the image. A wooden box about the size of a chalk box answers very well. One end is removed and a sheet of tracing or tissue paper substituted and fixed by folding over the edges and pasting. The hole should be in the centre of the other end. The smaller the hole the better the definition but the poorer the illumination, so it is best to start with a small hole and enlarge it until a satisfactory image is obtained. As a hole bored in soft wood has rough edges, it is a good plan to cut out a large hole and glue a piece of thin cardboard over this. The pinhole may then be made in the cardboard with a stout needle or bodkin. This method has the advantage that if a bad hole is made, another piece of cardboard can be glued on and another hole made. To see the image the head should be covered with a coat or dark sheet so that the tissue-paper end is in darkness.

If a wooden box is not available, a cocoa tin or other canister may be used. In this case the flat part of the lid is cut out and the remaining band used to



Pinhole Camera.
Hold the box about a foot from the eye, pointing the hole towards a boy. An inverted picture of the boy appears on the tissue paper.

fix the tracing-paper screen. However the pinhole camera is made, better results are obtained if the inside is painted a dull black. An ordinary camera may then be shown if desired, and the children told that it is like the pinhole camera except that it has a lens instead of a pinhole, and so gives a clearer picture. No attempt to explain the working of a lens should be made.

Children should be told that the eye is something like a camera. It consists of a dark box with a lens in front, but instead of a screen there is a bunch of nerves which take messages to the brain when light falls on them. Instead of being empty, the box of the eye (eyeball) is filled with a clear transparent jelly which helps to preserve the shape of the eyeball but does not prevent rays of light from passing. There is no point in giving details of the internal construction of the eyeball, but something may be said about Nature's method of protecting such a valuable piece of apparatus. The following points should be brought out.

Protection from damage by blows, eyeball enclosed in bony skull-box; cheek, brow, and nose bones protect it from frontal damage. Eyebrows direct perspiration from forehead towards nose or side of cheek, eyelids fitted with a kind of squeegee under the rims, also eyelashes as a further safeguard. A watery liquid flows continually over the front of the eyeball, draining through small holes in corner of eye leading to inside of nostrils. Dust in eye produces more liquid (tears) and much blinking (scouring action of squeegees).

The closing or opening of the pupil according to the amount of light has been dealt with in a previous lesson. This may be compared with the opening of the iris diaphragm on a camera.

A talk about colour will bring out the children's ideas. One of these is probably that white paper viewed through red glass looks red because the glass colours the light. Let them experiment with glass of different colours, using these at first singly and then two together, or even three. If the colours are fairly pure, they will find that while they can see easily through the red or violet glasses separately, they see practically nothing through the two together. Unfortunately, most coloured glasses are not optically pure, and in practice a blue glass may allow some red rays and a red glass some blue rays to pass. It is worth while to choose these sheets of glass with care and to obtain them from a recognized dealer in scientific apparatus. Coloured sheets of Cellophane can be bought, and in some cases found to have purer colours.

A little judicious experimenting by the teacher will probably make a satisfactory result possible, even if three colours or more are required to give darkness.

The information so far gained by the children should be noted and glass prisms given them to look through. A second-hand shop may be able to supply a broken mantelpiece ornament of the old-fashioned lustre type, and if so this will provide an adequate supply of prisms. Otherwise a single prism will have to be passed from hand to hand. The colours seen through a prism may be compared with the colours of the rainbow.

We now know that white light (ordinary light) is made up of all the colours of the rainbow. Sir Isaac Newton (early seventeenth century) stated

that there were seven colours: red, orange, yellow, green, blue, indigo, violet. Since orange may be looked upon as a mixture of red and yellow, and indigo of blue and violet, it is probably simpler to think of the five colours—red, yellow, green, blue, and violet.

Nothing should be said about refraction of light or about wavelength. A simple statement that the glass prism splits white light up into all the colours of which it is made will meet the case here. Newton's disc should now be shown with the colours painted on as sectors. This may be rapidly spun on a whirling table, on the end of a knitting-needle, or on a large spinning-top. It will be seen that the colours blend together to make something near white. A pure white is never obtained, as it is practically impossible to get all the colours pure and in the right proportion. The rest of the lesson may be in the form of a discussion, which ought to bring out the following points.

A piece of red cloth reflects only red rays to the eye, a piece of blue cloth blue rays only, and so on (Plate XXI). White cloth reflects all the colours, which mixed together form white. Red glass allows only red rays to pass through it, and blue glass blue rays only. Hence, when we look at a white surface through red glass only, the red rays among the many sent out pass through the glass to our eyes, so the white surface appears red. The red glass does not colour the light, it only cuts out all colours other than red. Hence, a red glass and a blue glass together should allow no light to pass, for the red glass lets only red rays pass, and these are then stopped by the blue glass behind.

If a blue light shines on a piece of red cloth, the cloth will look black because, as the red cloth cannot reflect blue light, it reflects none at all, and the cloth looks black. Blackness and darkness result from no light being reflected.

One interesting point may be brought forward from the class. If black reflects no light, why do brightly polished black shoes shine? The answer is that the shiny parts of the shoes do not look black, but white. This answer may not be well received at first, but its truth will be evident after examination of an illustration for some brand of shoe polish. It will be seen that the artist has used white for the parts he wishes to look shiny.

Children's Activities

(1) New words learnt: incandescent, prism, etc.

(2) Why can we not ordinarily see round corners? How could you arrange to see round a corner if you wanted to?

(3) If you were wearing a red frock or red tie, under what circumstances could it be made to look black?

(4) Find out how to make colour tops that blend colours in *Projects for the Junior School,* Book III, Chapter X (Harrap).

(5) Make a booklet about the "Story of Lighting through the Ages" (see HISTORY, Vol. II).

SOUND

Required: Tuning-forks, piano wire, hack-saw blade, small vice, metre rule, any available musical instruments to show strings, reeds, etc.; sounding-board, air pump, and small alarm clock if possible.

The sounding-board is not essential, but is helpful and instructive, although if a violin is available the sounding-

board may be dispensed with. The chief aim of the lesson is not so much to decide what sound is, but rather how sounds are made and how they travel. Experiments should be performed to show the vibratory nature of sound. A tuning-fork is sounded and held against the teeth, or against the edge of a post-card placed on a tripod. A few small pith-balls or pellets of paper on the card will be seen to jump as the vibrations of the fork are communicated to the card. The vibrations will also be felt on the teeth. A stretched wire or a violin string is plucked and note taken of the fact that it sways backwards and forwards to produce a sound. The words *vibrate* and *vibration* should be introduced and explained. With a shorter wire more rapid vibration and a higher note will be evident.

Other cases of sounds caused by vibration should be investigated; the parchment of a drum, the strings of a piano struck by a small hammer, the reed of a wind instrument, the metal of a bell, etc., a hack-saw blade in a vice. How does sound travel? A metre rule is held with one end touching a child's ear or the bone just behind the ear. If a watch is held a yard away from the other ear, the child does not hear the ticking, but if it is held against the other end of the metre rule, the ticking is heard distinctly.

A child puts his ear against one end of a long wooden form or desk and hears distinctly the scratching of a pin at the other end. Sound is evidently conducted more readily by the wood than by the air. The experiment may be repeated with a metal rod in place of the wood, with even better results. The classroom will probably furnish other sources of experiment such as a water-pipe or radiator pipe. Children may like to make a sound telephone. Two canister lids each pierced in the centre, with a string stretched between the holes and held in position by knots, will allow a whispered conversation to be carried on.

A child bites on the ring of a watch; the ticking is heard more distinctly through the bones of the head than through the air. The idea of wave motion is too advanced to be dealt with at this age. Waves and wave-lengths in relation to wireless sets are, however, familiar in these days, even to young children, at least by name, so they may be told that sound can travel by waves made either in air, wood, metal, water, etc. In general, sound waves travel better in solids and liquids than in air. Mention the scout who puts his ear to the ground to listen for the approach of friend or foe.

If an air pump is available, it may be shown that sound does not travel through a vacuum. A sounding alarm clock is placed under the receiver of an air pump and the receiver rapidly exhausted. The sound dies away and returns as air is readmitted. This experiment needs careful trial, as it is not easy to insulate the clock from the metal of the pump or the glass of the receiver. It may be placed on a thick pad of loosely packed cotton-wool or suspended from a rubber stopper in the neck of the receiver. A small automatic musical-box may replace the alarm clock, but this is not in these days easily obtained.

The question of the speed of sound should be introduced by reference to what is noticed at a cricket match by a spectator. The batsman is seen to strike the ball, but the sound is not heard

until later. Similarly, for a man seen and heard driving in stakes with a mallet, or the firing of the starter's pistol as seen and heard by the judges at the finishing-post.

It may be stated that light travels so quickly that the action is seen practically at once, but sound travels more slowly. Light: seven times round the world in one second, sound only eleven hundred feet in one second. Thus sound takes about five seconds to travel one mile.

Children should be practised in counting seconds. A good plan is for them to say aloud: "One little second, two little seconds, three little seconds," and so on. If they are timed when doing this, it will be found that when they reach twelve little seconds, say, the error is surprisingly small.

Mention may be made of the method of computing the distance away of a lightning flash. If seconds are counted between the flash and the thunder, the time interval will give an approximate measure of the distance away of the flash.

Echoes are always of interest to children. An echo is caused by reflection of sound from a large vertical surface such as a cliff, steep mountain, or large wall. The sound takes as long to travel back as it took to travel to the reflecting surface. If there is a good echo in the vicinity of the school, noises may be made at various distances from the echo surface to show that the echo takes longer to come back from a far surface than from a near one. It may even be possible, if the distance is known, to compute in this way the speed of sound. An echo may also be heard by reflection from the surface of the water of a deep well.

Children's Activities

(1) New words learnt: vibrate, vibration, echo.

(2) Try to find several tumblers or other glasses which give out a note when struck. Partly fill one tumbler with water and see if the note changes. Then try to so arrange the amounts of water in each tumbler that a row of tumblers can be used to play up the scale.

(3) If you can find a flat rod of boxwood, mahogany, walnut, or other hard wood, cut this into small strips of different lengths. Drop these strips one by one on to a wooden table or bench and notice if there is any difference in the notes caused. Perhaps by adjusting the lengths of the strips you will be able to use them to play a tune.

(4) If an echo from a mountain-side takes two and a half seconds to come back to you, how far are you from the mountain?

(5) The children read for themselves and carry out some of the simple experiments and projects to do with Sound in *Projects for the Junior School*, Books I–IV (Harrap).

Electricity

Required: Bicycle lamp or electric torch, household switches, electric bulbs, burnt-out bulbs, electric bell, any other available simple electric accessories, lengths of insulated wire.

Most children are familiar with the effects and uses of electricity, and small boys especially may show an embarrassing amount of knowledge of the subject. The teacher's chief difficulty will be to keep the lessons simple and avoid being led into involved explanations of things about which some children may have a wide but inadequate

acquaintance. Questions as to what electricity does for us will bring varied answers, such as lighting, heating, cooking, wireless, running trains, trams, and other vehicles; turning machinery and doing electro-plating.

An electric cycle lamp or torch with a battery of the flat type with brass strip terminals should be dismantled, the *terminals* identified, and the lamp examined. It should be shown that if one terminal touches the brass screw collar of the lamp and the other the blob of solder at the bottom, the *filament* of the lamp lights up or glows. A diagram of the lamp should be drawn on the blackboard to show that one end of the filament is attached to the brass collar and the other to the blob of solder. These, then, are the terminals of the lamp. The lamp should be connected to the battery terminals, and by alternately removing and attaching one wire the idea of a *circuit* is given. The wire may be replaced by other things such as string, a glass rod, a rod of vulcanite or other plastic, a penknife blade, etc., and then lists of conductors and non-conductors (*insulators*) made.

It may be pointed out, if the children do not remark it themselves, that most things that are good conductors of heat are also good conductors of electricity. The circuit in the complete torch may now be traced out. If the case is of metal, there will be no difficulty here, but if of bakelite, the metal conducting strips will have to be sought.

This investigation will call attention to the *switch* and should result in a talk on switches in general. An ordinary lighting switch should be shown, dismantled, and examined. The point to bring out here is that the switch is for the purpose of making or closing a gap in the circuit. Note that lighting switches on the wall are usually fixed so that the knob is pulled down for the "on" position, while power switches on the skirting-board are "on," or should be, when the knob is up. Children may like to discuss the advantages of this practice.

The torch battery may be used to complete an electric bell circuit containing a bell-push switch, and this switch should also be examined. The working of the bell need not be explained, but it is quite likely that there will be at least one boy in the class who will volunteer an explanation, and the wise teacher will probably encourage this.

Show lengths of insulated wire, both single and double, and discuss the reasons for insulation. Leads used for lighting and power circuits usually have rubber as an insulator and may be protected by an outer covering of lead. Certain plastic substances, such as polyvinyl-chloride, known as P.V.C., and polythene are now used in some cases instead of rubber.

It may now be pointed out that the lighting and heating circuits of buildings are just like the torch-lamp circuit, except that the current is greater and of course more dangerous.

Volts and amperes need not be mentioned, unless questions are asked by members of the class. In this case it is best to refer to the flow of water in pipes and say that volts are a measure of pressure and amperes of quantity of current. The electric current is produced at the power-house by a machine called a *dynamo,* and carried to our houses by insulated wires laid under-

ground. Current is carried from one district to another on the bare overhead wires of the grid. These are carried by *pylons,* high above the ground where there is no danger of them being touched. Mention the porcelain insulators on the pylons.

Discuss the possibilities and dangers of electric shock. The human body is a conductor, and if it becomes part of a circuit and a heavy current passes, a shock is felt which may kill. A shock may be obtained in two ways: by touching both wires of a circuit the current finds an easier path through the body than by going round the whole circuit. Secondly, if one wire only is touched, the current may run through the body to earth, for the earth is a conductor capable of conducting the current back to the power-station. Wet hands, wet feet, or wet ground increase the danger of shock, for water is also a conductor and helps to make a good contact between wire and body or wire and earth. Faulty switches, lampholders, and adaptors may become charged as a result of leakage, and metal parts of such appliances should not be touched until the current is switched off.

Children should be warned against trying experiments with household electric fittings. There is no danger from small lamp batteries, as the possible current from these is small.

An ordinary electric bulb may be examined and compared with the small torch bulb. One or two worn-out bulbs may be taken to pieces so that their parts and the connections can be seen. The bayonet type of fitting and the corresponding lamp-holder may also be examined.

In fact, the children will probably lead the teacher on from point to point, and the chief difficulty will be to avoid discussions of aspects of electricity that are beyond the scope of the lessons. At all costs these should be confined to simple points, such as the importance of the circuit, and the need for both conductors and insulators.

Why does electricity give us both light and heat? Heat is always produced when a current flows through a wire. The longer and thinner the wire, the hotter will it become. Notice the thin wire of the lamp filament. This gets so hot as to become incandescent, hence the bright light. If an electric bulb is touched after the current has been on for a few minutes, it will be found to be hot. In electric fires, cookers, and irons a long thin wire is made hot, but not hot enough to become incandescent.

Children's Activities

(1) New words learnt: terminal, filament, insulator, circuit, switch, dynamo, pylon.

(2) Make a list of some things you know to be good conductors and another of things that are good insulators.

(3) Why does a bird not get a shock when it perches on an overhead grid wire?

(4) Electricians tell us that radiators and other electric appliances should not be placed in a bathroom, and that the switch for the light should be fixed outside the room. If, however, it is placed in the bathroom, it should never be possible for anyone in the bath to touch it. Can you say why these recommendations are made?

(5) Read more about electricity and electric lights in *Projects for the Junior School*, Book IV, Chapter IX (Harrap).

There are also suggestions for many interesting things for you to do.

Burning and Breathing

Required: Thermometer, candle, gas jars and cover plates, length of glass tube, test-tubes, bell jar and pneumatic trough, lime-water.

As has already been stated, lessons on burning, breathing, oxygen, and carbon dioxide should precede studies of any changes which go on inside the plant. The lessons on related science in the four-year course have been largely confined to the study of physical phenomena. Some idea, however, of the constitution of the atmosphere and the simple chemical changes in which these constituents are involved is essential for the further study of plant and animal life.

Investigations into the nature of burning and breathing should be as simple as possible and confined to those aspects which are related to the simple facts of Nature. Nothing need be said about chemistry or elements and compounds, and no chemical expressions should be used.

Ask the children if they can think of any way in which they resemble a fire or a burning candle. We know that things that burn give out heat. Does a child give out heat? A child holds the bulb of a thermometer in his hand. Since the mercury rises, he must be giving out heat to the thermometer. Is the child burning? Some experiments may tell us more about this.

A short length of lighted candle is fixed by its own wax to the centre of a gas-jar cover placed on the table. A gas jar is placed over it and left until the candle goes out. The jar, without removing the cover, is now inverted and left for some minutes to cool. The cover is now removed, a few drops of lime-water poured in without delay, and another cover placed on the jar, which is then shaken. The lime-water is found to turn a chalky white. Although there is no need to mention this to the class, the delay for cooling is necessary because if the cover is lifted at once the carbon dioxide formed in the jar, being warm, may escape.

Evidently the candle in burning has done something to the air, because if a jar of ordinary air is shaken with lime-water there is no chalkiness. (Lime-water is merely lime dissolved in water, and is the same liquid that mother gives to the baby when he has tummy-ache.)

Next ask a child to breathe through a short length of glass tube into an inch of lime-water in a test-tube. This also goes chalky. (Note that the child need not take a deep breath before breathing out, it is the last part of the expired air that contains most carbon dioxide, not the first part.)

We now see that the air which a child breathes out has the same effect on lime-water as air in which a candle is burnt. Or we can say that a burning candle or a breathing child both appear to affect air in the same way. If we could do the experiments, we should find that all animals in breathing and all fires in burning do the same thing.

What else does a candle do to the air? Float a lighted candle on a flat cork or small board in a bowl of water and cover with a bell jar. The candle goes out as before, and after everything has cooled down the water is found to have risen about one-fifth of the way up the bell jar. The candle in burning appears

to have used up about one-fifth of the air.

Does a child do this in breathing? We cannot put a boy in a bell jar, but we have a record of an experiment with an animal. Joseph Priestley, a minister who lived in the eighteenth century, performed many experiments with burning things, and we know he did the bell-jar experiment in several ways. Once he put a mouse in a cage on the cork in a bell jar and found that after a time the mouse died, and he then noticed that the water had risen one-fifth of the way up the bell jar just as in the case of the burning candle. He then found that a lighted candle put into the same jar went out at once. The part of the air not used up by the mouse would not help the candle to burn. Some part (one-fifth) of the air must be useful for burning and breathing, and the remaining four-fifths not.

As a result of some more experiments done by Priestley, and also of a talk he had in Paris with a French scientist called Lavoisier, we now know that air is made up chiefly of two gases mixed together. One helps burning and breathing, and is called *oxygen*. The other does not help, and is called *nitrogen*.

There is also a small amount of another gas in air which we call *carbon dioxide*. This gas is always formed when things burn or animals breathe. It is this gas which turns lime-water chalky. Since animals are always breathing and things are often burning, we can see how this gas gets into the air.

You would think that as time goes on the quantity of carbon dioxide in air would become more and more and the quantity of oxygen less and less. This is not so; the proportion of carbon dioxide remains steady at about three parts in ten thousand parts of air. This is a good thing for us, because carbon dioxide, like nitrogen, does not help either burning or breathing.

We shall find out later that living plants are responsible for keeping the proportions of carbon dioxide and oxygen steady.

Children's Activities

(1) New words learnt: atmosphere, oxygen, nitrogen, carbon dioxide, etc.

(2) What gases are there in the air? Write what you know about them.

(3) Pour a few drops of lime-water into a shallow glass dish. Look at it after half an hour. Would you expect it to be chalky?

(4) Sometimes if a man has to go down a well to do repairs, he first lowers a lighted candle down the well. How does this tell him if the air is fit to breathe?

CHAPTER SIX

APPARATUS AND MATERIAL, AQUARIA, ETC.

If a special room is available for the science lesson, this should contain a demonstration bench or table with gas and water connections, and a sink. Tables or benches for the children to work at should also be fitted if possible. Where the science lessons are given in an ordinary classroom, a table must perforce take the place of the demonstration bench, and probably a spirit stove or electric hotplate will have to act as substitute for the bunsen burner. In any case the apparatus used should be as simple as possible. If experiments are too elaborate, there is a danger that children will watch them as they would a Punch and Judy show—as something interesting and amusing, but with no bearing on their usual activities.

The nature and use of any piece of apparatus shown should be explained in simple language. Thus a bunsen burner will be a little gas stove; beakers, flasks, and glass tubing will be saucepans, kettles, and pipes made of glass, so that we can see what is going on inside. The science cupboard should contain as much as possible of the following apparatus: bunsen burners, bat's-wing burner, tripods, one or two retort stands with several clamps, pinch-cocks or Mohr's clips, glass bell jar with well-fitting stopper, circular glass bowl (usually catalogued as a pneumatic trough), crucibles and pipeclay triangles, evaporating basins and wire gauze squares, round-bottomed flasks (100 c.c.), flat-bottomed flasks 100 to 250 c.c., beakers 100 to 500 c.c., one or two glass funnels, filter papers, thermometers (both Fahrenheit and Centigrade), lengths of glass tubing about 6 mm. external diameter, rubber tubing 5 mm. internal diameter; also some bunsen tubing, three-cornered file, supply of corks and rubber stoppers, set of cork borers 1 to 6, gas jars and cover plates. In addition, jam jars and fruit-preserving jars with airtight stoppers will be found to be useful, as will any odd saucers and dishes that may be available.

Some schools may possess a microscope, but this is not very suitable for young children. Experience shows that the average child sees little or nothing when peeping into a microscope. Magnifying-glasses are more satisfactory and can be handed round the class. Mounted dissecting-needles and one or two pairs of forceps are useful for moving and separating seeds and other small objects.

Care and Manipulation of Apparatus

All glass tubing used should have the ends rounded by holding in the bunsen flame. This prevents cut fingers and damage to rubber tubes and corks. Holes in corks should be bored from both sides, and not from one side only.

Rubber stoppers may be bored straight through, using water as a lubricant to the borer. Glass tubes should be wetted before fitting into rubber tubes or stoppers to make them slip in easily.

Magnifying-glasses

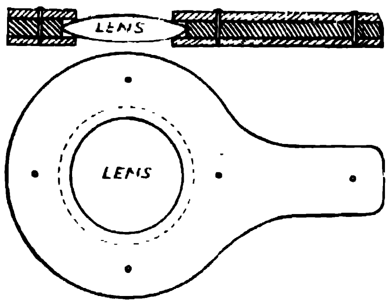
Good glasses are expensive, but round spectacle lenses of about 10 cm. focal length can be bought cheaply and mounted as follows: in a strip of three-ply wood bore a hole slightly larger in diameter than the lens and in two other pieces holes slightly less in diameter. Put together like a sandwich, the lens and the single piece of ply being the meat and the two other pieces the bread. Glue or fix with small brads and shape as shown in diagram.

Skeleton leaves may be made by soaking leaves in strong caustic soda solution for a day or two, washing with water and carefully scratching away the skin of the leaf with a fine toothcomb or a stiff toothbrush. This is, however, a tedious and uncertain operation, and it is much simpler to make a vein print.

Vein Print

1. Smear the leaf with blacking, using a soft brush. Next place a sheet of unglazed paper over the leaf and rub firmly with the hand. A good imprint of the veins is thus made on the paper.

2. A still better result is obtained by rolling over the leaf with an inked duplicating roller, using ordinary duplicating ink. The transfer may be made by laying the leaf, inked side downwards, on paper and passing the roller over again. This of course gives a black background, but if a sheet of paper is interposed between leaf and roller, the background is left white.



HOME-MADE MAGNIFYING-GLASS.

Leaf Silhouettes

Lay carefully-pressed leaves on paper. Dip a toothbrush in ink (ends of bristles only). Hold brush bristles upwards above paper and scrape bristles towards you with a toothcomb. This sends a fine spray of ink over the paper, and the leaves when lifted leave white silhouettes. This is suitable for children to do, and by making artistic arrangements of leaves some pleasing patterns may be made. Shading effects may be produced by adding extra leaves halfway through the spraying.

The Drying of Clay

Dry in an oven or over a radiator until hard. Break up into small pieces and dry again. Finally, grind to powder in a mortar and pass through a fine sieve. The small clay particles pass the sieve and the larger sand grains, if any, stay behind. Clay particles have diameters of the order of 0·005 inch, whilst particles of silt and sand are at least ten times as large.

Iodine Solution

Shake up two or three crystals of solid iodine in a bottle of distilled water and allow to stand. A straw-coloured solution is obtained which gives good results. A stronger solution

may be made, if required, by dissolving 10 grams of iodine in a solution of 20 grams potassium iodide in 30 c.c. of water and diluting to 1,000 c.c.

Insect Cages

For large insects a box with a glass front and a back of wire gauze is suitable. In many cases, however, glass jam jars are quite adequate. Perhaps the simplest way is to roll up a sheet of cellophane into a cylinder, tie round with string, stand on a glass plate and cover with another glass plate. Wood or cardboard may be substituted for the glass plates. The advantage of cellophane is that it is slightly porous to moisture. Thus there is no danger of condensed moisture running down the inside surface, as frequently happens in the case of a glass insect cage. In fact, with some glass-faced cages small insects have drowned in the condensed moisture. The cellophane cages may be of any size, and even small growing plants may be put in them for insects to crawl on. For simple inspection of caterpillars the glass Petrie dishes used for bacteriology are convenient.

Wormeries are made in the same way as the ant case already described, but of twice the width. The soil, however, should be moist and firm.

Aquaria

The school aquarium is always popular with children. The kind of attention it requires will depend to some extent on its size, shape, and the number and kind of its inhabitants. There are, however, certain fundamental principles that must not be lost sight of. The conditions should approximate as nearly as possible to those found in Nature, i.e. in ponds and streams. The chief of these are as follows:

The water receives light from the top only. The top surface exposed to the air is of maximum area, thus giving the best chance of aeration of the water. (The common goldfish bowl is bad in this respect, and should not be used.) Temperature changes in the water are very gradual. Plant and animal life are usually well balanced. There are shady as well as sunny parts. There are holes and crevices for hiding and shelter. There is earth at the bottom for burrowing.

The water in streams is constantly changing, and is usually more aerated than that of a pond.

As many of these conditions as possible should be reproduced in the school aquaria.

The glass-sided tank is popular because it gives a good view of what is inside, but if placed in a well-lighted window, the sunny side should be covered by a shade which can be removed for examination purposes.

For practical purposes several smaller aquaria give better results. Large, shallow tubs or dishes are suitable for many purposes. A large piece of turf used to line a shallow dish makes an admirable home, when filled with water, for tadpoles or for the larvæ of beetles, etc.

A permanent aquarium needs some care in its preparation. Several inches of well-washed river sand should be put on the bottom, and, if desired, part of the bottom may be covered with pebbles or heaps of stones. Water should be run in slowly on to a flat board which floats up as the tank fills and prevents disturbance of the sand.

Plants with lead sinkers attached are next put in and left to establish themselves. Fishes and other creatures should be kept for a day or two in separate vessels near the aquarium before being put into their permanent home.

Aeration is important; a well-balanced aquarium needs no aeration, but few small aquaria are self-contained. Small electrically-driven compressors can be bought quite cheaply, and if one of these is used to deliver a stream of fine air bubbles into the tank, the water will be kept adequately aerated. Intermittent aeration may be tried by connecting a blown-up football to the aerating tube and controlling the bubbles with the help of a screw clip (Mohr's clip) on the rubber connecting tube.

Another method is to arrange a small fountain to deliver a fine spray of water into the tank. The jet may be made by drawing out a piece of glass tubing to a fine bore. The nearer the spray is to a mist, the better is the aeration. As an alternative, a fine trickle of water may be allowed to drop into the aquarium from a height of some feet. This can be arranged by having two equal-sized tanks, one above and one below the aquarium, the lower tank being filled by the overflow. When the top tank is empty, it is refilled from the bottom tank. With tanks of two to three gallons capacity the flow can be adjusted so that filling need be done only once in twenty-four hours.

Food given to the inhabitants will depend on their nature. Vegetable feeders will probably get all they need from the growing plants, but watercress, lettuce, and crushed biscuit may also be given. For the carnivora, gentles, bloodworms, chopped worms, liver, or horse's heart will serve. Daphnia, the larva of the fresh-water flea, obtainable from aquarium dealers, is a useful standby. The so-called ant's eggs are of little value.

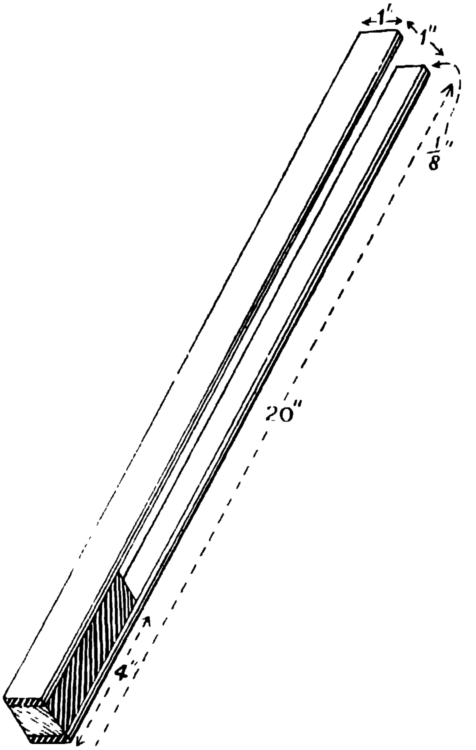
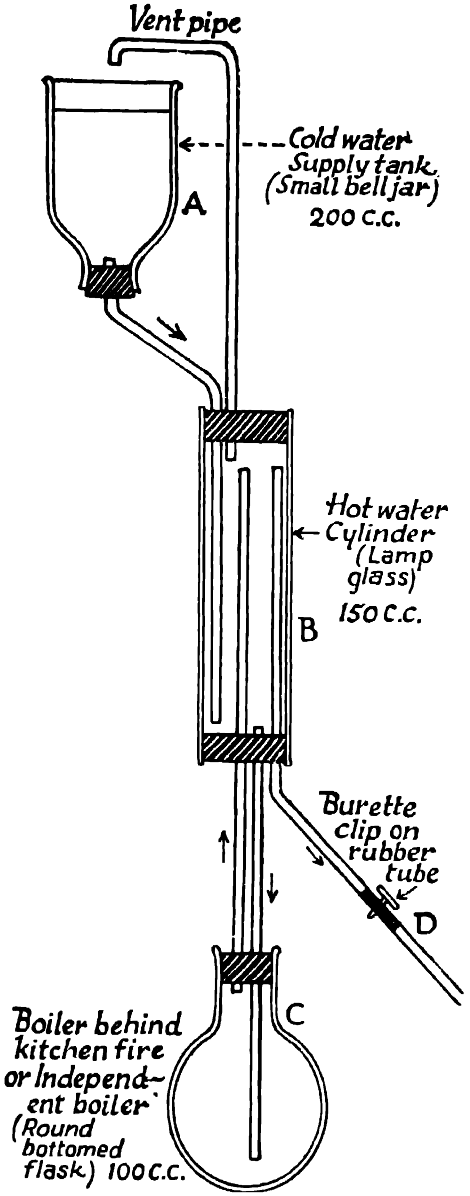


DIAGRAM TO SHOW HOW TO MAKE AQUARIUM FORCEPS.

Give plenty of food, but take care to remove uneaten food before it decays. For this purpose aquarium forceps are useful and can be easily made. Wood from the blade of a broken T-square is suitable for the prongs. The diagram is self-explanatory.

The green alga that grows in water exposed to sunlight interferes with the view of the contents of an aquarium, but is otherwise not harmful; in fact, it is good for the fishes, as it provides both food and shade. A small copper-bottomed raft floated on the water has been known to prevent its formation,



HOT-WATER SYSTEM.

but is of no use if the alga has already got a hold. Water-snails introduced into the water will feed on the alga and keep it from becoming too thick. The snails will lay eggs and breed, but many eggs will be taken as food by fishes. A rubber squeegee on the end of a rod may be used to clean the slimy green coating from the inside of the glass.

Any fish showing signs of fungus growth should be removed at once and placed in salt-water, one tablespoon to the gallon, kept in a darkened place, with daily changes of water. The disease is infectious, so watch must be kept for it. A pinch of salt in the aquarium from time to time is helpful to keep the inhabitants in good health.

One of the best plants for aeration purposes is *vallisneria spiralis*; other suitable plants are *elodea canadensis* (American pond-weed), *ranunculus aquatilis* (water crowfoot). Duckweed, which floats on the water, is useful, as it provides both shade and food.

As a rule, fish from rapidly flowing streams do not take so kindly to aquarium life as those from ponds and other stagnant water. Pugnacious fish, like perch or miller's thumb, should be kept separate, but most vegetable-feeding fish live happily together. Sticklebacks are better kept in a separate tank with plenty of pond-weed in which they can build nests.

Any of the following fish may be expected to thrive in an aquarium, provided that it is not overcrowded and that no sudden changes of temperature are allowed: goldfish, sunfish, tench, bream, char, dace, roach, chub, gudgeon, bleak, minnow, dogfish, cat-fish.

Hot-water System

The model illustrated is not difficult to make, works well, and can be filled and emptied without removing any corks. The sizes given are those of an actual model that has seen much ser-

vice, but both sizes and vessels may be varied according to material available. Rubber stoppers are better than corks, and a round-bottomed flask is less likely to fracture than a flat-bottomed one. The ends of glass tubes which just pierce a stopper should not project, or air bubbles will gather. The draw-off pipe represents the lead to the hot-water taps of a house. The whole should be fixed with clamps to a retort stand.

Fill the system to the level indicated by pouring cold water into the supply tank A; next fill the supply tank with a solution of potassium permanganate (purple). Now draw off water from the tap D until hot-water cylinder B is full of coloured permanganate. Refill A with more permanganate. The system is now ready for use.

Heat boiler C with a small bunsen flame without gauze. The coloured liquid will descend and the clear water will rise, showing good stratification at the top of cylinder B. When the whole system has become coloured, pipe D may be opened, permanganate run off, and clear water added to A until A and B are clear and C only is coloured. Heating may then be continued.

To empty, invert the apparatus and open tap D. Finally, blow down D to empty bend of vent pipe V. If, after much use, the glass becomes stained, fill with dilute sulphurous acid (solution of sulphur dioxide) and leave for ten minutes or until clear.

PAINTING AND PICTURE-MAKING

CHAPTER ONE

THE FUNCTION OF THE TEACHER: METHODS AND MATERIALS

IF we are to become successful teachers of art, we must first consider the nature, not of the art, but of the children we are to teach. If we think about children, or, better still, watch them, we shall see that the most striking thing about them is their incessant activity. They are always doing something. It is through doing things that interest them that they gain experience and grow up. The process of growth is continuous though its speed and direction may vary; our function as teachers is to provide the most favourable conditions for this spontaneous process. Children will grow up best if they do so in their own way, that is, if they are able to approach their activities in the way that is most natural to them. If we watch children at play we shall see that this approach, like the artist's, is creative; it is not the consciously planned approach of the workman. They do things for the sake of doing them; their make-believe or dramatic play is done, not so much for an audience as for themselves; it fulfils a creative need. Since, as art teachers and educationists, we are concerned especially with the potential artist in each child, our emphasis will always be on the side of the creative activities.

Most people are aware that great changes have taken place in art teaching in recent years. The old academic methods of teaching have been largely discarded in favour of quite different ones. It is not only that the methods and materials of teaching have changed. It is found that in those schools where the best work is being done the whole atmosphere of the classroom is different; a new and subtle relationship has grown up between teacher and child. The change in method and materials has arisen partly from our better understanding of the psychological and emotional needs of the child and partly from our changed view of the meaning of art. In the past there was a widespread belief that a work of art should present a faithful likeness to nature; this being so, the purpose of art education was to teach the child how to copy accurately. Beginning by drawing simple objects such as boxes and cubes, he was taught how to measure, and to draw in per-

spective and shade, at an age when none of these could mean very much to him or be of any use. His work was judged by adult standards; the nearer it approached to these, the better it was considered. If by the time he was fourteen or fifteen years old he had picked up some of the technical tricks employed by grown-up artists, he was considered a most promising pupil. Overloaded with technical equipment which he had never been able to use imaginatively, the desire to create was gradually stifled. By the time he was considered sufficiently competent to compose pictures of his own, he was quite unable to make use of the style which it had taken him years to acquire.

The sterility of this kind of training was recognized as long ago as 1938 by the Board (now the Ministry) of Education, who said, in their official *Handbook of Suggestions for the Consideration of Teachers:* " It is clear that training in draughtsmanship, although it may still be of value as a means to an end, is not a sufficient end in itself. The love of drawing, painting, and making things seems to be instinctive in every normal child. By such means he expresses ideas about the things which surround him long before he can use the written word, and this outlet for his lively imagination must be fostered and developed to the full."

Writing earlier, in 1936, Marion Richardson, whose brilliant pioneer work as a teacher and as an Inspector under the London County Council was largely responsible for the official recognition of the new methods, says: " We have changed our methods, partly because we no longer think of art as man's effort to imitate the appearance of the natural world, but rather man's effort to express his realization of an underlying harmony, and also because we have discovered that children have their own individual approach to art and the beginnings of a technique of their own which are inseparable from their way of seeing and experiencing things."

When we speak of the expression of ideas in this connection we mean the visual images of the mind's eye, together with the observations of the physical eye, through which, in common with the artist, the child is able to communicate his thoughts, feelings, and emotions. This approach to art is natural to the child; it is the gift which he already holds in his hand. It is our privilege as teachers to train him to preserve the integrity of his vision and to look upon it as a rare and precious possession in a hideous world of false values. Instead of teaching him merely to copy the external appearance of nature as we see it ourselves, we shall from the beginning encourage him to " see " his own mental imagery clearly and to record these ideas truthfully in his own language. This will not be possible if the child's original idea is destroyed by the impositions of the teacher, nor will he retain his ability to " see " inside his head clearly if the activity of self-expression is neglected. The first concern of the art teacher should be to create the conditions and to provide the materials that will enable the child to express his own ideas; it is by painting that the child will learn to paint and to acquire an adequate style of his own.

In the Infant School, drawing, painting and modelling are completely spontaneous activities which do not need

any direct help from the teacher. Beyond providing whatever may be necessary and creating an atmosphere of happiness which will enfold the child, she will need to do little more than give him her sympathetic encouragement and support. It is probable that the young child is largely preoccupied with mental images which are not directly related to the observations of his physical eye; his early drawings are symbolic rather than representative, and this state of affairs continues well into the Junior School.

It is in the Junior School that the spontaneous creative efforts of the child should be followed by the enlightenment of tuition. Through the power of suggestion we may illumine the child's mental image much as a spotlight picks out the prima ballerina on the stage, bringing the central figure of the dance sharply into focus. By using the power of suggestion we shall not be teaching the child how to draw but how to "see inside his head" (a combination of thinking and feeling). We shall be training him to depend on the trustworthiness of his own visual imagery—a part of his imaginative experience—rather than on the second-hand information which is thrust upon him before he is ready for it. Knowledge acquired in this way and unrelated to experience is of no use to him.

Each individual teacher will find her own way of using the power of suggestion, but whatever this may be, the idea that is presented must always be a *visual* one—something which may be seen either with the mind's eye or the physical eye.

The approach to picture-making is generally made through pattern. This is a natural means of expression for young children; the basis of a primitive form of decoration may often be seen in their childish scribbles, and they do not distinguish between pattern and picture. Their pictures have the rhythm and movement which are characteristic of a good pattern, and often incorporate actual pattern forms, as in a dress, a carpet, or a wall-paper. Good picture-making springs from a fundamental sense of pattern. Between the ages of seven and eleven, children should be painting both patterns and pictures. In due course, the more imaginative children will dispense with pure pattern in order to express themselves more fully through picture-making. Other children will carry the pattern activity a stage farther, applying it to potato cuts and fabric printing. The child's natural inclination towards pattern-making may be turned to account by using rhythmic forms which are closely related to the forms of letters, to lay the foundations of a good cursive handwriting.

In the Junior School, although the emphasis will always be on creative and imaginative work and should continue to be so throughout the whole of the child's school life, it should be recognized that some children, when they are about nine or ten years old, begin to draw upon the observations of the physical "eye." As the child grows older, other modes of self-expression present themselves. His ever-widening experiences tend to blur the vivid intensity of his earlier imagery, and at this time he may begin to show an increasing interest in factual observation. Looking out of the window, for example, he will see the familiar scene with a new eye—"the observant eye" —by means of which he will record his

impressions of the external world. We should see that these children have the opportunity for drawing the things that interest them. They will be learning to look at the things they see around them and to store up these visual impressions because they want to paint them. Again, we shall not attempt to teach the child "how" to draw a table, a street, or the corner of a room, but by explaining some of the underlying structure of what he sees in terms of simple vertical and horizontal planes, we shall be able to help him to understand what he is looking at.

Nothing at all in the nature of true perspective should be taught in the Junior School, though some preparation for the later use of this convention may be made when the occasion arises.

It is because some children are at first unable to interpret what they can see with the physical eye that they become dissatisfied with, and critical of, their own work, and begin to lose confidence. The familiar graphic symbol for the man, house, or tree no longer satisfies them. They begin to notice a confusing quantity of detail, a great deal of which they do not understand. Here we may help them to select from the scene before them (which may be actual or memorized) those things which interest them most and are essential for the purpose of their picture. It may not be possible, for example, for the child to paint a picture of a whole garden at once; he will either have to paint a picture of the part he likes most or imagine a garden for himself in which he can put the various things that he has in mind and which may be different parts of the real garden—the pond, the swing, the apple tree, perhaps; if he thinks about the real garden, he may succeed in getting the "feeling" of the place into his imaginary picture in a way which would have been quite impossible if he had been allowed to sit down and "copy" a piece of the actual garden. It is at this stage in his development that the understanding and encouragement of the grown-up is all-important to the child. He needs to be convinced that we approve of his work and believe that his pictures have a value of their own. Our appreciation and anticipation of his difficulties will be a source of real encouragement. By training the child to look at and understand what he sees around him as his powers of observation begin to develop, we shall be laying the foundation of the work which he will do when he begins the secondary part of his education.

The activity of appreciation is only possible in a lesser degree in the Junior School, but here, too, we shall prepare the way for sensibilities which will develop later. As Herbert Read says: "Until then (adolescence) the real problem is to preserve the virginal intensity of the child's reaction to the sensuous qualities of experience—to colours, surfaces, shapes, and rhythms" (*Education Through Art*). Throughout the Junior School we shall endeavour to give children the opportunity of examining all sorts of different objects which will stimulate their curiosity and develop their tactile sense. As the child grows older, he will begin to enjoy looking at things for their own sake, observing in a still-life those relationships of colour and form which seem important to the artist. The acquisition of the "painter's eye," besides enriching the child's everyday life, will also provide

him with an important clue to the understanding of pictures. These should be carefully chosen for those qualities which a child can understand and enjoy at this stage. It is just as necessary to learn how to look at pictures as it is to learn how to listen to music.

So much for the change of methods. Let us next turn to the problem of suitable materials. A child will only be able to express himself fully if he is provided with materials which he can handle with ease. The younger he is the more he needs the kind of material which will offer the least resistance. Strongly coloured chalks which respond easily to the touch, or paint which can be mixed quickly and may be used thinly or thickly, opaquely or transparently, are much more suitable for children than chalks which break easily but require pressure before they are effective, or cheap paint-boxes filled with hard, intractable cakes of colour. Unsuitable materials will add to the child's difficulties and frustrate him, besides destroying almost entirely the sensuous pleasure of painting—one of the child's chief joys. The most expensive materials are not always the most suitable for children, but the tools which we provide must be adequate for the job; for example, brushes of various sizes are needed, while different kinds of paper of different shapes, colours, and textures and a wide range of pigments will stimulate the child to experiment and to discover new ways and means for himself.

It will be found that the natural creative urge in each child will flourish only if the kind of atmosphere in which children can be natural and happy has been created by the teacher. *It is certain that the child will make his maximum effort only if he is enjoying whatever he is doing;* this enjoyment is in turn partly dependent upon the social happiness of the whole group. This intangible atmosphere, which makes creative work possible, is largely independent of physical conditions; it is a quality of personality which may be developed or acquired, but cannot be taught. It is the outcome of the teacher's personal relationship with the children, and is probably her most important contribution. Marion Richardson has defined this relationship in the following way: "It is not too much to say that unless a relationship amounting to love exists between teacher and children, children's art, as it is now understood, is impossible."

This relationship will be one of mutual trust and partnership, for while anticipating the needs of the child the teacher herself will remain impersonal and self-effacing. Herbert Read sums up this attitude when he says: "Teaching demands a high degree of asceticism; joyful responsibility for a life entrusted to us, which we must influence without any suggestion of domination or self-satisfaction."

CHAPTER TWO

TEACHING THE SEVEN-YEAR-OLDS

A First Lesson

"A CERTAIN hardening in our demands, a certain stiffening in organization and in the standards of work, at the change-over from the Infants' to the Primary School, undoubtedly finds response in children's own feelings. They like it to be a real change, a real advance." (*The Children We Teach*, Susan Isaacs.)

The standard of the work done in Infants' Schools today is so good that the teacher of the lower groups in the Primary School often profits by the free and natural way in which the children have been accustomed to draw and paint. There has usually been such a friendly relationship between children and teacher in the Infants' School that the Primary School teacher will inherit an unspoiled keenness when the children come to a painting class.

The new world in which the child finds himself should not be completely different from the one he has known. Much of the work and ways of the new life should be linked with the old, for it must not be forgotten that the child's development is a process of growth, and that he proceeds from one phase to the next gradually. The break in the departments of school life is in the main an artificial one, for our convenience. Although there is no sharp dividing-line in the mind of the boy who has left the building marked "Infants" and is entering the one marked "Boys and Girls," he is beginning for the first time to feel that he is no longer a baby and to want to be treated as a more responsible and grown-up person.

Before, he has been largely "playing at painting," now he will begin to learn some of the craft of picture-making—how to use and care for his tools, when to use his paint thickly and when thinly, and above all to mix his own paint. Thus he will learn to control the material at his disposal, and in this way will gain confidence, which in its turn will leave him freer to express his urgent and growing emotional feelings. Perhaps the first lesson to be given to the youngest class of children in the Junior School might be one on the use and care of the materials and of the more "advanced" things that he is going to be allowed to do with them.

The Use of Materials

In the past he has often had his colours ready mixed in jars, and these have been given out to him one at a time as he needed them. There has probably been only one red, and he has had to use it straight out of the pot without the chance of making it lighter or darker, more orange or more purple. Now he should be given dry powder colours, in bun-tins (Fig. 1), with no addition of water. If he has a six-section bun-tin, he might have the following set of colours: red, lemon-yellow,

blue, white, black, emerald-green, or yellow ochre. The first rule he must learn about his new paints is that he must never pour water into the paint-tin. He must dip his damp brush into the dry colours which he requires and then mix on palettes, old saucers, or pieces of rough paper. His brush must always be clean when he starts to mix a new colour, otherwise the freshness of the colours will soon be lost and all the other paints will become "muddy."

Now we shall give out the brushes so that each child can handle one for himself. He will have had brushes before, of course, but now he is going to learn something new about them. Tell him that his brushes are like his friends, they will only respond to him if he treats them well. They will behave well for him if he cares for them as his good servants and not as his stubborn and overworked slaves. He must stroke his brush into shape (especially if he is lucky enough to have a fine sable). He must never paint with the "heel" or press the brush down with all the hairs splayed out (Fig. 2). It will look like a sweep's brush and will not easily recover from such treatment. Something like this might be said to the class: "Your brushes are one of the tools of your craft, like a carpenter's chisel or saw. Care for them and use them to paint the shapes you want, don't scrub to and fro as if you were scrubbing a floor; you will spoil your brush and take the 'surface' off your paper, making it rough and nasty. Use your big brushes for painting big things and little brushes for little things. It would be silly, for instance, to try to paint a big piece of sea and sky with a tiny brush, or a fairy's eyelash with a great big one."

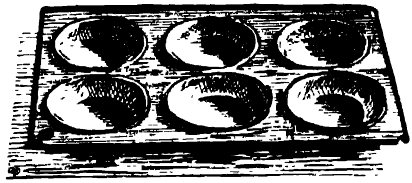


Fig. 1.

While he paints, the child will learn to use only a little water and to paint thickly. If he uses water freely, his paper (often of the semi-absorbent variety) will become soggy and the colour will look wishy-washy and feeble. He will lose much of the sensual pleasure of painting if he uses paint in this way.

If he wants to make his colours lighter, he must use white paint, not water. If he has not had white to use before, he will find this very exciting. When he begins to paint with the new colours, he might be encouraged to make pink, pale blue, grey, buff (i.e. yellow ochre and white) on his piece of rough paper. He must be urged all the time to experiment with the new colours on his own account.

The exercise of "taking a line for a walk," which is fully described in the chapter on Patterns, will give him an excellent opportunity of experimenting with paint at this point besides introducing an elementary form of pattern-making to him.

Initial Difficulties

Since mixing paint will probably be

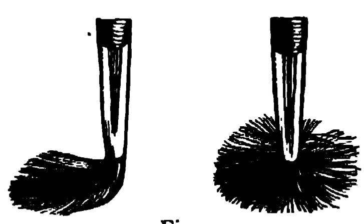


Fig. 2.

new to him, a wonderful vista, full of the subtle pleasures of the imagination, is now opening out before him. By giving him a little practical help at first, we shall set him off on the magic path that painters tread; for a lively and significant sense of colour lies dormant in all children—only encouragement is needed to awaken this special gift of theirs.

The choice of the subject and the way in which it is set are always very important and are dealt with in detail in Chapter V. For the purposes of the early lessons with seven-year-olds a very simple pattern (see Chapter IV), or an imaginative subject, might be chosen.

The children will have been making all sorts of adjustments to their new life in the Junior School, and will have so much to learn that is new to them that it will be wise to proceed slowly, and not rush or confuse them with too many new ideas at once. Care must be taken that whatever is set is well within their scope both mentally and physically, that is, within the limits of the muscular control they will have gained at this stage. We shall see that the pattern is a very simple one, made by "taking a line for a walk" or by using easy letter-forms (see Chapter IV).

Two or three suggestions of this sort might be put on the board so that children may choose two with which to make their patterns. Similarly two imaginative subjects may be used. They should be carefully chosen from the everyday life with which the children are familiar: "The Motor-bus," "Train" or "Ship," "Our House," "In bed at home." Young children should not have too much choice: it only confuses them. The whole class should do either the pattern or the picture on this occasion, and this decision rests with the teacher. Those children who know what they want to paint in the way of a picture, or who know which letter-forms to use for their pattern without any outside help or suggestion, should be left to get on with their work. However, children who, at other times when they are more settled down, are well able to work out their own ideas may need suggestions and the security of class work to steady them and start them off at the beginning of a new school year.

When children begin to paint pictures of people, they may ask: "What is hair colour?" "How do I make sky colour?" The answer to the first question is "Look at your friends sitting near you. Is their hair all the same colour?" The child will see dark hair, fair hair, red hair, and so on. Then one can say: "Very well, you see there is no hair colour, so choose the colour that you want to have in your picture and try to mix it on your mixing-paper. I will help you if you can't get what you want." To the second question: "How do I make sky colour?" the answer is much the same: "Does the sky always look the same? Is it the same on a hot sunny day as on a wet cold day? Then what sort of 'day' is your picture? Is it windy with little puffs of cloud, or stormy or clear? You must feel what sort of day it is in your picture, and then you will know what colours to paint." All questions of what colour something ought to be, in an imaginative painting (as distinct from painting which is a factual record), should be answered in this way. The child must learn that there is no quick way, no easy rule, no chart or table (colour systems and charts are particu-

larly misleading) for him to use; it all depends on what he feels and what he has to "say" in his painting. He can have what he wants and what he feels to be right. The teacher can never say, "This is the colour for a face or a boat," but rather make suggestions, such as, "Paint the face a little darker, so that it will show more" or "Here is a lovely colour you have mixed by accident—why not use this for the sails?" In order to do this she must have something of the painter's eye and inward vision, as well as an understanding of the child's needs and desires. She should help him to clarify his own vision for himself, and then teach him enough craftsmanship to enable him to express himself fully.

Simple Rules

There are one or two other simple and practical rules that the children must learn, and here it should be emphasized that all rules of this kind are only useful so long as they serve their purpose. When the child has learned to use his brushes properly and to control his paint as he wishes, in short, to be the master of his tools, he will know enough to know when to adapt the rules he has learned to his own needs.

When he has painted part of his pattern or part of his picture, it will be time enough to tell him to wait till this part is dry before he paints on it or very near it. While he is waiting, he can get on with another part of the picture, sometimes by moving round to the other side of it, or turning his picture upside-down. If he paints on to work which is not dry, his painting will only look muddy and messy, and he will be most disappointed with the result.

At the end of the lesson, or when he has finished an exciting piece of painting, a child will often pick up his paper and proudly carry it wet and dripping for the teacher to see. In this way a charming piece of work may be ruined beyond repair; because it has not been carried flat the paint has run in all directions and the picture is spoiled. Before this can happen, it is best to say that all the pictures must be left flat and still upon the desks or tables until they are dry. Some time must be left for a tour of inspection round the room to look at the work that has just been done. This inspection, which the children will look forward to, may be held after the clearing-up has been done, when everything has been put away, and the children are sitting down again, each one beside his painting.

It is almost always necessary to allow ten minutes for clearing-up, though this depends on the size of the class, the age and sense of the children, and whether there is a sink in the room or not. A sharp eye must be kept on the clock so that the children may be given a few minutes' warning before it is time for them to stop, in order to give them the chance of finishing the piece they are working on. Children become happily and completely absorbed with their work and should be allowed to paint on undisturbed till they have finished This is not often possible in schools today, unfortunately, but at least they must not be suddenly told to stop; this only makes them feel frustrated, and in this frame of mind they will do the clearing-up resentfully and inefficiently. Either at the beginning (and this is better) or at the end of the lesson, every child should put his name

and class on the back top left-hand corner of his paper. Having the name in the same place always makes sorting out the work later very much easier. Nowadays children often have to work on both sides of the paper, and if this information gets painted over, it must be painted in again before the end of the lesson.

The few points of craftsmanship mentioned above will apply to every painting lesson. There are other technical points, which can be taught, but these are best digested if they are given when the need for them arises (see Chapter VI). The elementary rules which will help both child and teacher when using powder colour or poster colour are:

(1) Never allow water to be poured into the paint-containers. The paint will be thin and transparent when it is used instead of stiff and opaque, and the paint left in the tins forms cakes which dry and crack. These behave like the cheapest and worst paint-box paints, and are therefore useless. If they are washed down the sink, they block the pipes.

(2) Teach the children to care for their brushes and to treat them with respect. Brushes whose bristles or hairs have been allowed to get out of shape will not work properly and are no pleasure to use. The right-sized brush should be selected for the job in hand: large ones for covering large areas, small ones for detailed work, and so on.

(3) Always add white to make a lighter shade, never add water. Powder colour and poster colour should be used stiffly and opaquely at first. The paint is far more easily controlled in this way, and the colour bright and vigorous.

(4) Teach the children to wait while one piece of painting dries before putting more paint on top.

Clearing-up

In order to get the clearing-up after each lesson done quickly and efficiently, it is best to experiment with various ways of organizing it, and then to stick to whichever plan is found to work well. The details of such a plan will depend on the ages and background of the children and on the physical amenities of the room, i.e. whether there is a sink, and if not, how far the water has to be carried, etc. Once a plan has been decided upon and found to be successful, it should always be followed, then each time that the clearing-up has to be done, the children know what is expected of them.

If the group of children is a small one (15–20) and the room a reasonable size, each child can wash out his own water-pot and brush and put his paint-tin and other things away. In larger classes with little open space between the desks, it is better to have the children sitting in their places, the collection of water-pots and paints being carried out by a few chosen ones. These children should be chosen by some rotation, alphabetical or otherwise, so that every one in the class does his share of the work. As educationists we should teach the children to finish a piece of work off properly; as artist-craftsmen we should teach them to care for their tools, how to clean them and store them. For this reason every child should be taught to clear up neatly, not only for the sake of the class that follows but also for the sake of the tools. Here are a few simple points to remember:

(1) Always leave time for the clearing-

up to be done properly and without a rush.

(2) Water-pots and brushes must be washed perfectly clean. Clear brilliant colours such as young children especially enjoy cannot be obtained unless the water and brushes are clean to start with.

(3) Brushes should be shaken dry, and are best kept standing on their handles in a large crock or jar. They must never be left standing on their heads; they quickly lose their shape and are then useless.

(4) When bun-tins are used for paint, they should be stacked-up alternate ways across each other. Otherwise each tin gets messy underneath from contact with the one below.

(5) Paint-containers with screw caps or lids should be tightly closed at the end of the day. Any inks that have been used should be corked at the end of each lesson. They dry up very quickly.

(6) Special materials, such as sable brushes, scissors, stencilling brushes, inking rollers, or cutting tools, are apt to go astray unless they are counted after they have been used.

CHAPTER THREE

A SECOND LESSON

THE lesson which has been described in Chapter II has been given in that form for two reasons. Firstly, to introduce the children to the new and more varied materials which they will now be using and to accustom them to the greater freedom and independent choice that the handling of these will give them. Secondly, to give the teacher some indication of the way in which she may plan the lessons which are to follow.

All children derive undoubted benefit from the activity of painting and drawing, just as they do from dancing or making music; but if their artistic progress is to be as continuous as is the physical development of healthy children, then they need to be nurtured, that is, they need the sympathetic guidance and help of the skilled teacher. In her turn the teacher must know something of the work and development of each child if she is to be of any real help to him. This knowledge can be gained in several ways: by watching the child while he paints, by giving his work a careful examination after the lesson, and by considering him as a whole in the light of all his work and play at school, his social relationships, and his home environment.

Grouping the Pictures

If the child's work is examined after the first lesson, it will be possible to make plans for the next four or five lessons, which in their turn will be the basis of the work for the rest of the term. Let us now consider a set of work which might have been done by a typical class of seven-year-old children.

It will be found that the work can be divided into three main groups. In the first group will be the work that has been selected because it is better than the rest; in the second group will be the work which we shall call average; and in the last group we shall put all the work which seems either backward or unsatisfactory, or both.

Group I—Good Work

By good work, we mean work in which the child has expressed himself with ease and confidence. His pattern is a rhythmic decoration, his picture tells us what he feels about the subject he has chosen. He paints with absorption and enjoyment, using his materials boldly and without fear. He knows what he wants to do, and he knows how to set about it; his work will reflect his satisfaction. Why is this work better than the average and what is it that we are looking for? It is more imaginative and alive, both in the treatment of the subject and in the colour; it often has a remarkable sense of pattern or of balance. The colours that have been chosen are expressive of the subject; sombre, dramatic, or gay. The whole picture may be more controlled-looking because the paint has been

HIAWATHA (Boy 8 years) Size 20 in. × 15 in.

PLATE II

PATTERN (Boy 11 years) Size 20 in. × 15 in.

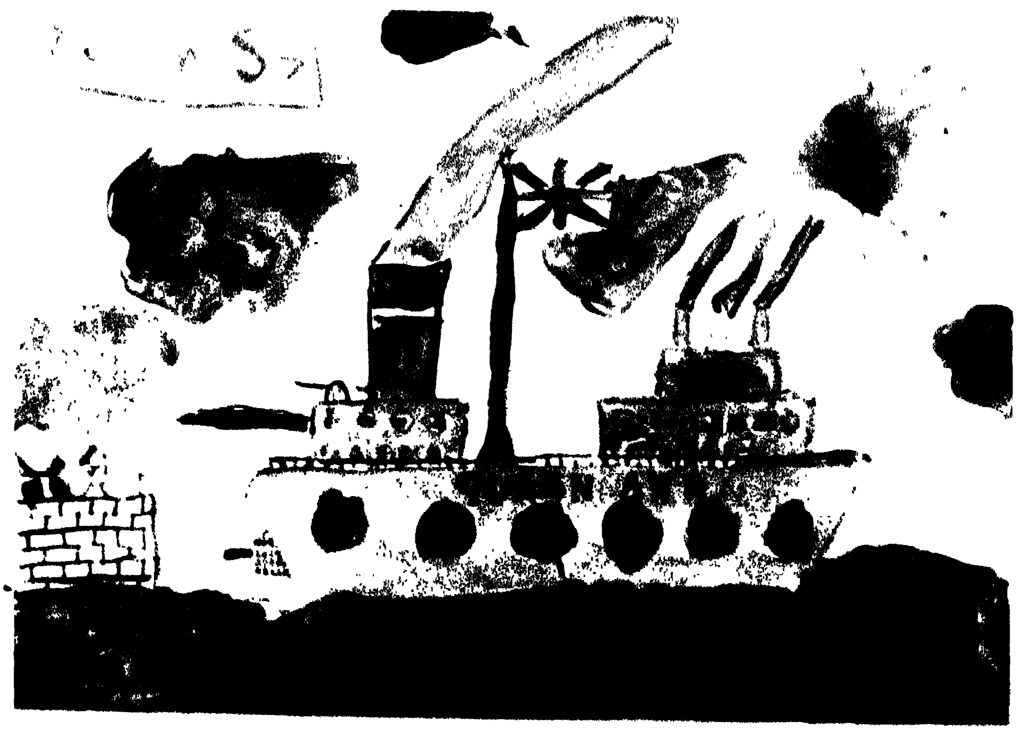
PLATE III

STEAMER TRIP ON LOCH LOMOND (Girl 8½ years) Size 21½ in. × 15 in.

This picture was inspired by the recollection of a holiday in Scotland. The child is of Cypriot parentage, which may account for the richness of colour.

PLATE IV

(*a*) LOCOMOTIVE (Boy 9 years) Size 12¼ in. × 10½ i



(*b*) SHIP WITH GUNS FIRING (Boy 7 years) Size 22 in. 14¾ in.

handled with confidence, but it is not necessarily neat or tidy; it may be quite vigorously and roughly handled. All good genuine work done by young children is child-like and naïve in quality; they paint the world around them as they *feel* it, not as they see it. Their pictures are not "something like the pictures done by adults only not nearly so well drawn"; they possess many of the qualities of imagination, colour, form, and composition which contribute to the making of a work of art. *Pictures by children should never be judged by adult standards.* Such things as proportion, perspective, anatomy, light and shade, and so forth, are of no importance in young children's work. Children should never be made to feel that these complicated and essentially adult subjects are necessary in the making of their pictures. Technique in the usually accepted sense is quite out of place in the schoolroom. The art school is the place for this.

We shall not be surprised, then, if on looking through our good paintings we find many in which the paint has gone over the edge. In painting, mere neatness is no virtue in itself and should always be regarded with suspicion in the work of young children.

Children's art is akin to the art of primitive peoples, and in their disregard of naturalistic proportion in figure-drawing this is particularly noticeable (see Plate I). This is not something to be corrected, but something intrinsic in their work which has to be accepted. We shall find that though the concept of the figure by a seven-year-old child has developed considerably from that of a four-year-old, at which age it is apt to have an embryonic appearance, it is still far removed from our own adult concept. Similarly, we shall find many other familiar symbols being used for such things as birds, trees, houses, or ships, for the child at seven is not making factual records of what he sees, he is using all kinds of graphic symbols to express his *ideas*—to tell us how he feels. He is still using the colours he likes, to express these ideas, so that he does not consider colour in its relation to nature. He may paint a blue or green face, a yellow tree or red grass; but however strange this may seem to us, we shall recognize that the relationship of these colours to one another is often unerringly right (right, that is, from the artist's viewpoint, for it is the artist's vision, not the camera's mechanical record, that we are concerned with). It is this instinctive feeling for beautiful colour, the child's natural and wonderful gift, which must not be destroyed by interference or suppression.

Finally, we shall probably find that many of the paintings look unfinished in the sense that the paper is incompletely covered. Often the sky is represented by a strip or band of colour at the top of the paper, a common sky symbol, and the paper is left bare until the foreground is reached; there is no distance or middle distance, for the child paints the ground at his own feet in his pictures; he does not experience distance, so he has nothing to say about it. It sometimes happens, however, that his understanding of colour is complete enough for him to use the colour of the paper, white, grey, or brown, as an independent colour, bearing its proper relationship to the other colours in his scheme. His painting is thus not necessarily unfinished merely because every inch of the paper has not

been painted over. White paper, because of its brilliance, is often used in this way quite naturally, and this unconscious knowledge is most useful when it is consciously applied to pattern-making at a later stage. The questions of the unfinished painting and the use of the background in pattern-making are both dealt with more fully in Chapter IX.

Here it is necessary to describe a type of painting which is often mistaken for good; this we shall call the neat, tight painting. This type of tidy, painstaking work can be easily recognized at all ages; it is usually done by children whose natural freedom of expression has already been cramped by having adult standards of achievement imposed upon them. Instead of employing the significant graphic symbols which are to be seen in all genuine work done by young children, they use the slick " learn-to-draw-in-five-minutes " type of symbol which adults use at party games—the cottage loaf, for example, " just add the ears, tail, and whiskers, and it's a cat "—the cotton-wool cloud sitting on the horizon, the rising sun, and so on. Their ideas are equally outworn and derived from the cheap second-hand ideas of the advertisement hoarding, the cinema poster, and the multitude of badly illustrated children's books. Often, children who have been ruined in this way have a photographic memory and a facility for drawing, so that they quickly pick up the slick tricks of the trade and are able to reproduce them over and over again in their work. Fortunately, comparatively little of this kind of work is found among the younger children in the Junior School; they are generally quite unspoiled at this age. Some ways of recapturing the child's ability to imagine and to create by restoring his self-confidence are suggested in Chapter IX.

Group II—Average Work

We now come to the second group of pictures which we have collected together and labelled average. Here we shall find many of the qualities which we noticed amongst the best work, and all the various modes of expression which are commonly used by children of this age and which have been mentioned above. We shall find that the work in this group has a strong family likeness; the pictures and patterns show a similar stage of development, and for this reason may be regarded as average seven-year-old work. Sometimes it will be found that the two groups tend to be indistinguishable. This is a most satisfactory state of affairs, and when the progress of a class of children is reviewed later it will be interesting to see how far this has happened. Even so, there will nearly always be one or two exceptional paintings; these will be the work of especially gifted individuals. At any stage in the Junior School, however, it is perfectly possible for almost the whole class to be doing really good painting; it is not the prerogative of only the gifted, but the inborn talent of each child.

Backward Children

Lastly comes the work which is well below the average, and cannot be classified as any of the kinds mentioned above. It may seem to be unsatisfactory, either because it is backward and undeveloped-looking, or because it is simply poor in quality and execution. We can usually distinguish between the

work that is done by children who are backward and work that is done by those who, without apparently being backward in other respects, appear to find this subject especially difficult. It is noticeable that children whom for one reason or another we call backward seldom do bad painting—on the contrary, it often happens that those who are academically behind the average will do very well at art or music; their intelligence may be developing more slowly and may not be of the academic type. With children of this age we shall find that whilst most of the class are using seven-year-old modes of expression there are some children who are still using the symbols which we associate with the work of the five–six-year-old child, and their paintings will have a distinct look of the Infant School rather than the Junior School. Much of this work will be very good indeed, and we shall put it among the "good" and "average" work. It will inevitably look more childish, and it may look more untidy because it will be less well controlled, but these things will not necessarily detract from its real value. We shall hope to find that unconscious sense of balance, exciting colour, and forthright statement which are characteristic of the work of the very young and the envy of many an artist.

We shall realize that there is nothing wrong with pictures which remind us of an age below the chronological age of the child who painted them. The important thing about the growing child is that he should continue to grow. By this we do not mean only gradually getting bigger, but something far more complex and subtle. Nature knows no fixed average, and though all children grow and develop in much the same way, they do not proceed at the same *rate*. If, then, we think of some children as backward because they are developing more slowly than others, we must bear in mind that nothing we can do will advance their rate of development. The child must be accepted at the rate at which he is going.

Group III—Poor Work

In considering our third group, however, we are chiefly concerned with work which is poor both in quality and content; in which the child has not found the means with which to express himself. It has all been too difficult for him; he is afraid of it and sometimes he has hardly got going at all. These children are muddled and confused; they don't know what it is they want to do nor how to do it. They feel that they "can't draw," and that painting is still more hopeless for them. If we watch them at work, we shall see that they are uneasy and lacking in concentration. They fidget about, rubbing out what they have put in, unsatisfied and frustrated. Amongst the best work we shall have noticed the easy rhythmical swing of the pattern or the confident statement in the picture; here we shall find the reverse—pattern forms shaky and uneven, with no rhythmic coherence, and in the pictures niggly little objects placed here and there about the paper without any apparent relation to one another; the whole conception being rather lifeless and lacking the vividness and conviction of the better paintings. Here are the children who need our help most; they need to have their self-confidence restored, *they need teaching*. The causes of their unsatisfactory work usually lie

below the surface of their lives and are in many ways beyond the teacher's control and outside her province. The art teacher, however, can perform a special function by helping to rebuild the child's confidence in his own ability, and in doing this she will also be helping him to face some of his difficulties in other directions.

All kinds of methods have been evolved by different teachers for restoring the child's confidence in his own powers and helping him to recapture his imaginative vision. Some of these are mentioned in Chapter IX and are suitable for older children. For young children, two exercises of special value are suggested:

(1) Painting directly with a brush or "taking a line for a walk."

(2) Returning to simple pattern-making, first stage (see Chapter IV).

Teaching Groups I and II

Before considering these methods in more detail, we shall return to our first two groups, the good and the average, and decide how their lesson may best be planned. It has been said that the children who are doing good work know what they want to paint and know how to set about it. These able and gifted children are much better left to paint what they want without interference. They may need a few initial suggestions and occasional help with technical difficulties *as they arise*, but so long as they are busy painting, it is wise to give them a wide freedom of choice in subject-matter and to encourage each to solve his own technical problems, thus learning to be self-reliant; in this way they will derive far more real satisfaction from their work.

The second group of children who are doing "average" work may be treated in very much the same way; the only difference being that they will probably need more suggestions as to what they shall paint and more help with their craft. The teacher's objective should be to help these children to grow imaginatively, so that they may be able to express themselves freely and independently and thus raise the standard of their work to the level of the first group. The first group may do either patterns or pictures, whichever they prefer. It will be found, particularly at a later age, that there are children who are imaginatively advanced enough to be able to express their thoughts and feelings more completely through picture-making than by means of patterns. As Evelyn Gibbs has said, in *The Teaching of Art in Schools*: "The very imaginative children will not be very much interested in pure pattern and its application, and will want to go on expressing their ideas in pictures. As soon as any individual outlook is apparent, the teacher should allow the child to do the subject that interests him. The class can be divided into groups according to the size and conditions, some children working at pattern, some on imaginative painting —not necessarily progressing from one to the other according to set routine."

Most of the second group may also choose whether they will do patterns or pictures, or may alternate between the two, but there may be some among them whose work is uneven and who would benefit considerably by experimenting for some time with patterns (with an occasional picture in between) and developing the pattern much farther until its basic principles have been absorbed.

Each time a new pattern is begun, more subtle and intricate arrangements of the familiar forms with all sorts of variations in colour should be tried (see Chapter IV).

It will be necessary then to choose two or three subjects for these two groups of children to use if they wish. One might be of the "homely" type, closely connected with the child's daily life, such as is suggested in Chapter II (see also Chapter V). The other two subjects may both be imaginative; one of the fanciful fairy-tale kind, for example "Cinderella arrived beautifully dressed," or one may be drawn from the kind of lessons which have become part of the child's imaginative experience, such as stories from the Bible, history or poetry whenever these are suitable (see Chapter V).

Before leaving the first two groups of children to work without much help, one further point must be made in connection with the slower children, who, though appearing to be somewhat backward, are painting well and will be working with the good and average ones. Their confidence in their own powers must be retained at all costs; they must not be discouraged by adverse criticism or comparisons, and it will sometimes be necessary to see that the subjects they attempt are not beyond their capacity. Those suggested for the most able children may possibly be too complicated for the slower ones, who have not reached the same stage, but often they may be able to tackle the same subject as the others, provided that it is presented to them in a simpler way. All the work that they do, whether patterns or pictures, must be well within their scope and such as they are capable of doing with ease.

TEACHING GROUP III

Having decided what all those children who are able to work by themselves with only a little suggestion shall do, we may now concentrate on the remaining ones who need our help the most. These children should return to the beginning of pattern- and picture-making. They should start with very simple patterns directly painted with a brush; the motives may be of the simplest—zigzags, waves, etc. (see Chapter IV, Pattern).

They must be provided with large half-imperial sheets of paper. If no paper of this size can be obtained, newspaper may be used, with fairly thick opaque paint. The paper should be folded by the children so that the creases may be used as lines: these must be at least two inches apart. If the desks are too small for the paper to be used comfortably on them, it is advisable to let the children work on any available floor space. Large brushes which will hold plenty of paint and cover the paper quickly should be used. These ought to be held at some little distance from the end, about the thickest part, so that the hand is not resting on the paper; the strokes are then made by broad and generous movements from the shoulder-joint, and not by the jerky movements of the fingers or wrist.

The sizes of these materials are not just one of the fads of the so-called "New Art"; they are suggested in this instance because they perform a special function. The child will overcome many of his difficulties if he can be persuaded to work boldly on a large scale; from covering the paper with strong effective colours rapidly, he will get a sense of power and will also see

the results in a very short time. To begin with, colours may have to be mixed for this section of the class to enable them to get on quickly with the main business of painting and to prevent them from wasting time just messing about. At first only two colours need be used, but a little later on three may be chosen by the child or may be suggested by the teacher. Colours such as red, yellow, and black or brown, yellow ochre and blue, will go well together in equal quantities. (Dark pinkish-red and a strong bright blue do *not* look well in equal quantities.) These colours can be used in simple alternate bands of pattern. As the child's understanding of the basic principles of pattern-making increases, more elaborate arrangements of both motive and colour, in all their variety, may be suggested to him, though he will soon be experimenting and inventing on these lines for himself.

Thin paint in pale pastel shades only looks well on dark-coloured paper, and here pure white paint can be used with great effect. Watery paint should always be avoided.

All the drawing, either in patterns or pictures, should be done directly with a brush; some children who have become timid may find this an alarming prospect at first, particularly if they have sunk to a habitual use of the rubber. A little encouragement, added to the sensual pleasure of handling colour with a large brush, will help them over this difficulty; it is important, too, to urge them to paint with the whole arm. In this way they will be much less likely to make small, cramped-looking paintings.

Sometimes it may be necessary for the teacher to start the child off by actually painting a line or two of pattern for him. This will help him if it is *not done too well*. He must not be made to feel that is beyond his power to copy such perfection. A useful dodge is to do the painting for the child with the left hand, and not too carefully at that. We shall find out for ourselves some of the difficulties that the child is up against in this way. For his part, the child will notice two things: (1) that it is really pretty easy after all; (2) that we do not mind, at this point, if it goes over the edge and is a bit crooked.

The size of the paper can be quite frightening to children who are not accustomed to it. Toned paper or news-sheet is less alarming than white, to begin with; if they cannot make a start on this, it is wiser to reduce the size to half but to increase it as soon as they appear to be making some headway on the smaller paper. The folded paper will supply the lines along which they can work, and if the zigzag or the wave touches the lines both above and below, this will help them to keep the pattern straight. It is not that the child really cannot do the work, but that he *thinks* he cannot. He himself must be impressed with the ease with which he has covered his paper with a colourful and altogether exciting pattern. We must retain an air of calm matter-of-factness: "But of course, I knew you'd be able to paint something lovely." We expect it of him, and our attitude should reflect this.

Every one of the children who succeeds in covering his paper, whatever size it may be, with some sort of pattern should have his work displayed after the lesson. Encouragement and enjoyment should be the keynote.

CHAPTER FOUR

PATTERN

Value of Pattern-making

THE desire to decorate and make patterns is as old as man himself—his earliest utensils, weapons, and ornaments were decorated with simple rhythmic or geometric designs made by the very tools that fashioned the article; the potter's thumb was used to decorate his pots in the same way that the cook today uses his thumb or the handle of a spoon to decorate the edge of his pie-crust. Simple abstract shapes, which it is thought may originally have had some symbolic significance, are universally used by primitive man and are the basis of the complex, highly developed decorations of great civilisations (Fig. 3).

The practice and understanding of pattern-making appear to be an essential part of intellectual and emotional growth. Just as babbling and crawling are the prelude to speech and movement, so pattern-making is the natural preparation for writing and picture-making. The very simple "up-and-down" scribblings of a young child correspond to the rhythmic stamping of feet and clapping of hands in the dance or the accompanying beat of the drum.

Methods for Developing the Pattern Instinct

Pattern-making should be practised for its own sake; children love to do it, and by their happy absorption in their work we may feel sure that it makes a real contribution towards their growth and development. Picture-making is pattern-making taken a step farther. Both of these activities have qualities in common. The good picture has the balanced look of the pattern that has been thought of as a whole and not in unrelated pieces. It is less formal or symmetrical, but still it has within the limits of its frame the essential rhythmic movement which is intriguing to the eye and with which we are familiar in the pattern. A good understanding of pattern will provide a valuable foundation for both picture-making and art appreciation generally.

Whether we begin to teach pattern-making to infants or to older children, we shall first use those fundamental abstract shapes which the young child uses instinctively. These shapes may be developed into the rhythmic all-over pattern in two distinct ways: in the first, "taking a line for a walk," the abstract shapes are painted or chalked all over the paper in an informal arrangement. The second

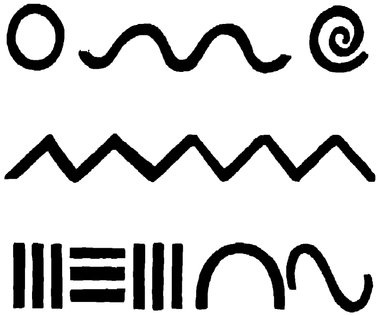


Fig. 3.

method consists of the rhythmic repetition of more formal shapes, such as the zigzag, the wave, or circle. Either of these methods, if developed logically, will teach the child the basic principles of pattern-making. The first method will help to develop his sense of colour and his appreciation of the sensual qualities of paint; the second, while developing his rhythmic sense, will help to give him the muscular control which is necessary for both drawing and writing. It is clear that the child will benefit most when both methods are used concurrently.

TAKING A LINE FOR A WALK

"Taking a line for a walk" consists in wandering about the page with chalk or brush, drawing irregular abstract shapes. Some of these are then filled in with different colours. Later, other irregular lines may be drawn over or round the patches of colour. Any day very young children may be seen either at home or in the nursery school painting in this way. What is chiefly striking about these early works is the strong feeling for pattern that is common to them. Because this is the young child's natural way of painting, it is especially suitable as an introduction to pattern-making for infants and for children of 7 and 8 years in the Junior School.

Stage I.—The child is told to fill his brush with any colour that he likes and take a line for a walk all over the page.

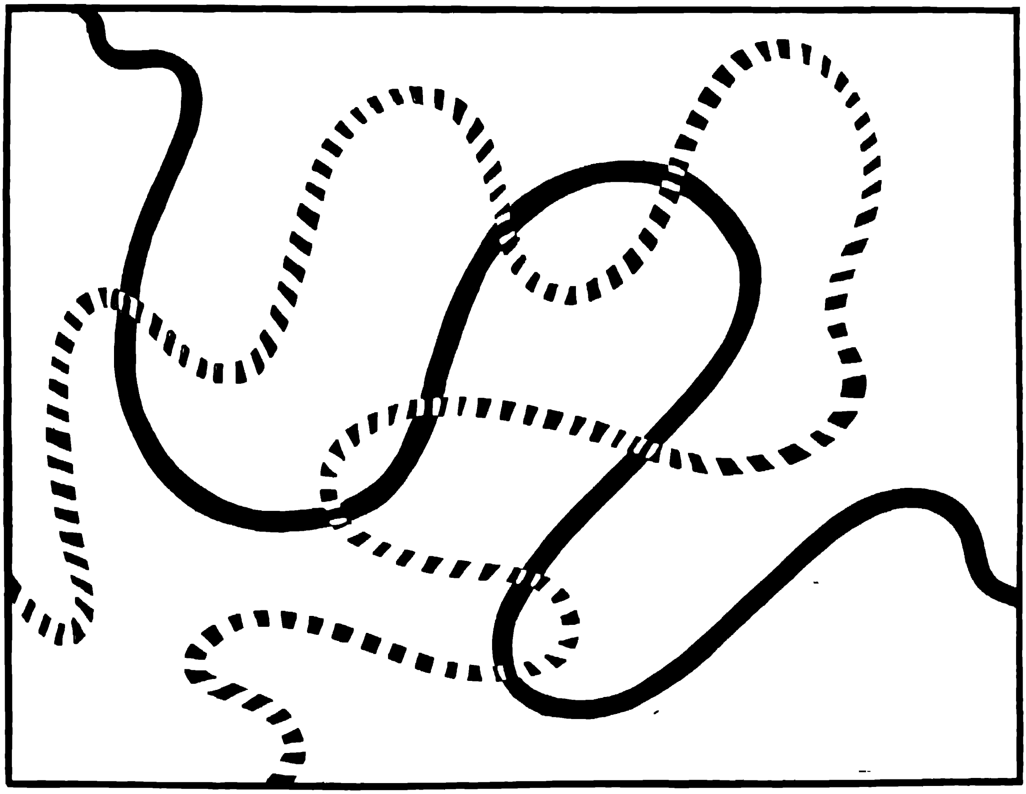


Fig. 4.

If the shape that he has drawn is a simple one which does not fill the paper, he should choose another colour and take another line out to meet the first. This line may coincide with or overlap the first (Fig. 4). He then paints or chalks the irregular shapes between the lines any colours that he pleases. The young child usually colours the shape all over, while the older one will often decorate some of the spaces with stripes, wavy lines, or dots.

Stage II (Fig. 5).—This time the child begins by making a border round his picture; this may be a single coloured strip that is painted round the edges of the paper, or double strips with a painted decoration in between. He then takes his line for a walk to " see " the border that he has made, and he will make it touch each of the four edges of the picture in turn. In this way he will be thinking and working all round his picture. As before, another line may be interwoven across the first one, if the child wishes, and the spaces may be decorated with colours and patterns (Plate VI*b*).

Stage III.—Now the child is asked to paint a solid shape anywhere on the paper, but not exactly in the middle (Fig. 6). He then takes a line for a walk to " play around " or over this shape, proceeding as before to fill in and decorate the spaces. These three stages will not necessarily be reached in three lessons. Many children will enjoy spending several lessons on each stage. Besides absorbing the principles of pattern,

Fig. 5.

they will be learning how to mix their colours and control their paint. By the time the third stage is reached we shall notice a fluency and poise in their work.

Stage IV.—Until this stage is reached the child has been perfectly free to invent his own shapes and to arrange them more or less as he likes. Now he is taught how to arrange shapes according to a formal plan. His paper is divided up into sections according to its size. At this stage it is better to divide small-size paper into only four sections; each section should not measure less than 6″ × 5″. A shape is painted in the first section (top left-hand corner) and repeated exactly in the other three, then a line is "walked" over and around the original shape and is repeated in the other sections. Although the shape is painted inside the section, the line need not observe such close boundaries; it can be painted over the edge of the section into the opposite one, provided that this can be repeated in each section as before. This will help the rhythm to flow from section to section so that each piece of pattern is dovetailed into the next rather than joined to it (Fig. 7). Each new addition to the pattern, whether of lines or shapes, must be repeated all over the page. Those children who have worked through the earlier stages of this method will appreciate the importance of considering the pattern as a whole; they have been thinking of their pat-

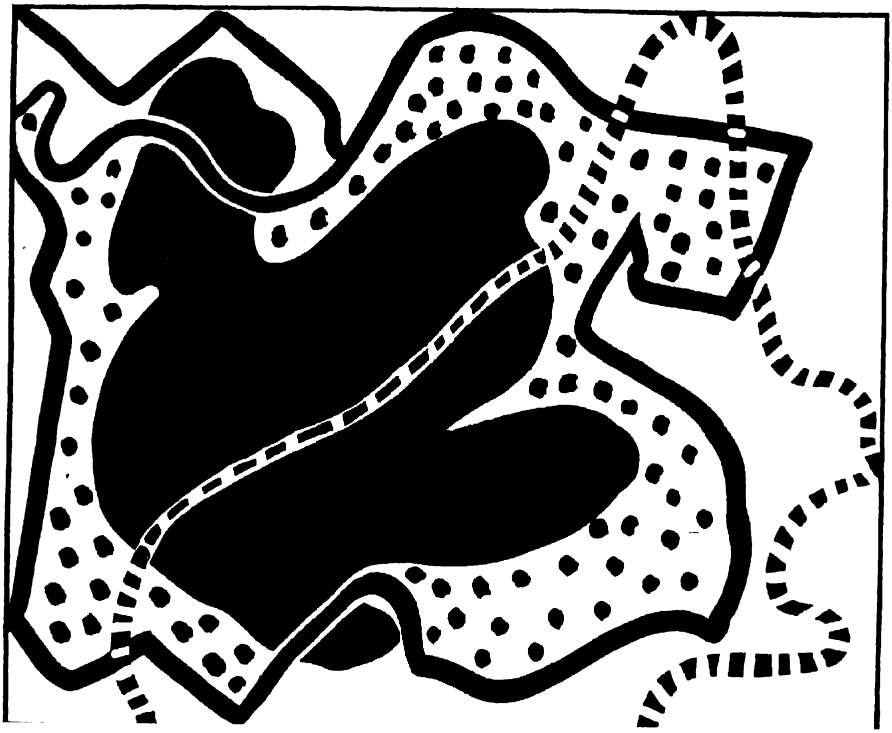


Fig. 6.

terns in this way from the beginning. A variation of the rectangular sectional pattern is made by folding a square piece of paper from corner to corner in both directions so that lines run diagonally across it. Starting at the centre, the child paints a shape in one section and repeats it in the other three sections, following this up with a regular or irregular line which is repeated in each section. The pattern may be completed by filling in the shapes and using decorative forms such as spots, wavy lines, or crosses.

Children who are learning pattern-making by the method "taking a line for a walk" should have a wide range of powder colours at their disposal and enough rough paper to mix them on. Abstract painting offers splendid opportunities for experimenting in mixing colours, an experience of greater educational value than merely using the crude pigments straight out of the pot. It is noticeable that the work of children who have been trained in this way has a painter-like quality and is distinguished by its lovely colour.

The use of this method in the Junior School has its dangers. It gives the child freedom to play about with paint, and there are occasions, which have been referred to, when this is valuable. It also offers an opportunity to experiment with colour and a skilful teacher will see that this chance is not lost. "Taking a line for a walk" is not, however, a way of making a picture—a soft

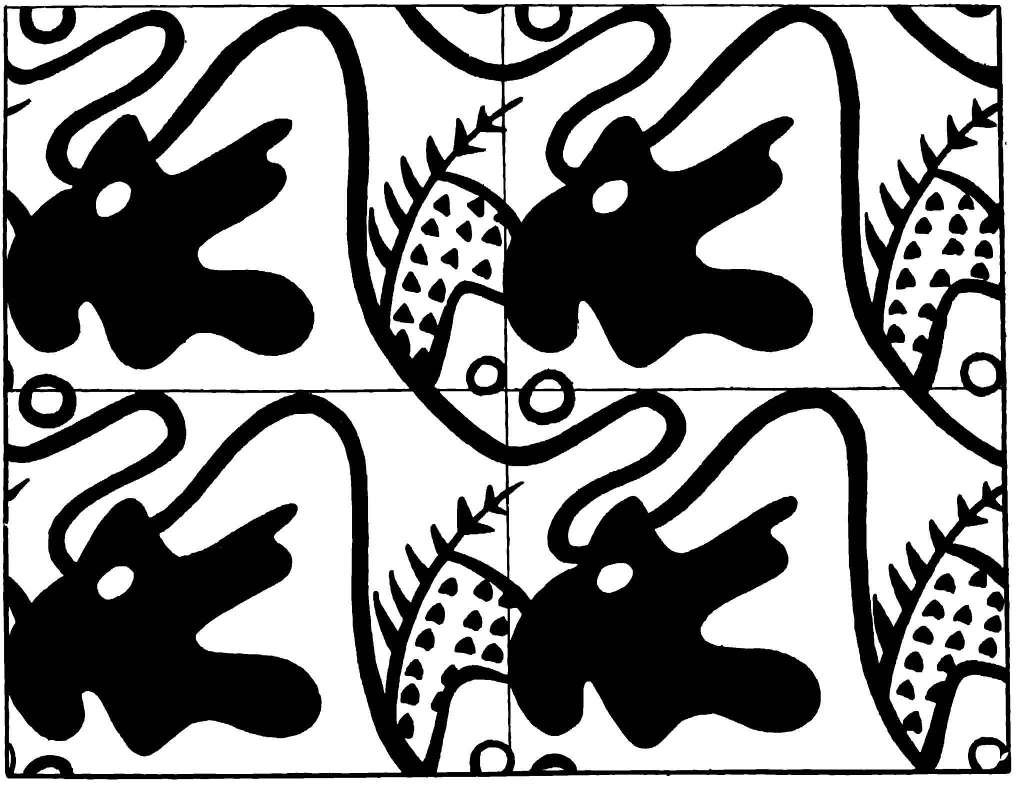


Fig. 7.

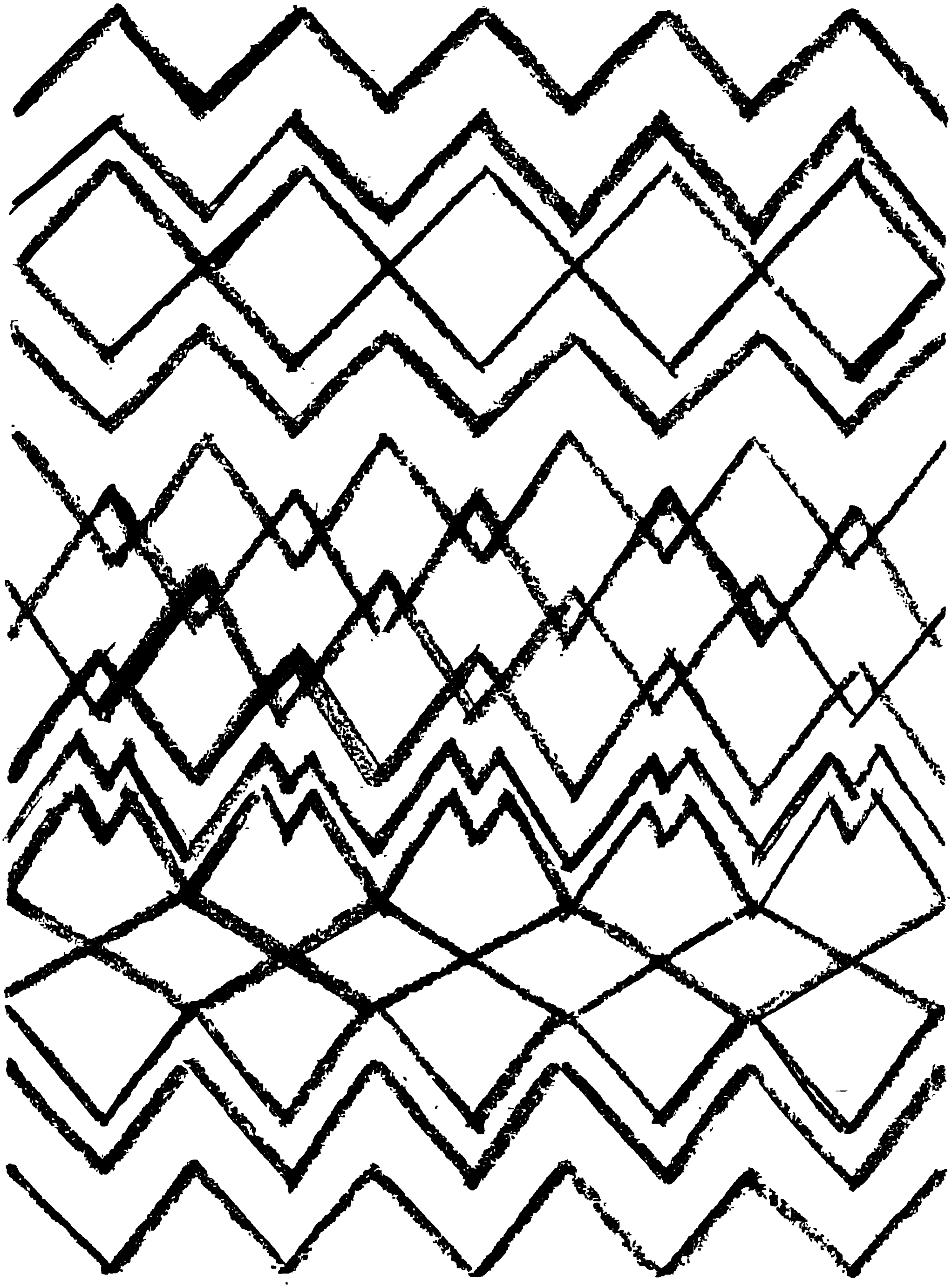


Fig. 8.

option for the teacher. Unless it is used intelligently as a means of introduction to formal rhythmic pattern-making, it will become merely a blind alley, and so stultify the child's further development. Whereas in the Infant School freedom to play about with paint is a necessary part of the child's training, in the Junior School his growing mind requires more mental exercise and the discipline imposed by set limitations.

The Formal Rhythmic Pattern

We come now to the second method —the development of the pattern by rhythmic repetition of such formal shapes as the zigzag wave and circle. Using one of these—the zigzag, for example—we shall teach the children some of the ways in which the pattern can be varied although the same unit is used throughout (Fig. 8). This will be done by reversing the rhythm or by alternating, superimposing, or partly overlapping the shapes.

We shall find that it is not the shape or unit in itself which makes the pattern, but its rhythmical arrangement in relation to the whole. Many children will already be familiar with this use of abstract shapes when they arrive in the Junior School, especially with those suggested by Marion Richardson, to which reference will be made later. The basic forms of letters used in cursive writing, which are closely related to the abstract shapes mentioned above, may all be used by children who are beginning to make patterns in this way (Fig. 9).

When the child uses the or or pattern rhythm for the first time, he will follow our suggestions as to how he may arrange his pattern, but as soon as he has completed one or two pages he will begin to invent for himself. By using shapes that he can understand and draw easily, and by showing him some of the ways in which these can be arranged, we shall be giving him the key to a rich and endless variety of patterns while teaching him the muscular control which is necessary for both drawing and writing.

As soon as he begins to "play about" with one simple unit or motive by repeating or varying each line of the pattern, we shall know that he has grasped many of the possibilities that lie within his power, and has perhaps laid the foundation of good picture-making as well. In Chapter IX, pattern-making will be suggested as one means of reviving the creative urge in children when this has been inhibited or partially destroyed. We shall also find children who may be able to make some attempt at patterns from seeing the work of other children, but they will not know how to invent or explore for themselves, nor where to search for fresh inspiration for their motifs. There may, too, be older children whose writing needs a general overhaul; these will benefit from going rapidly through the very early stages of pattern-making, with special reference to writing patterns.

Making the Pattern

Both the children who are beginning this kind of pattern for the first time and those who are returning to the first stages should be supplied with the following materials: either coloured chalks which are easy to handle and responsive, or charcoal, or large hog-hair brushes and powder paint. Any cheap paper with a matt surface will do. Kitchen or baker's wrapping, or

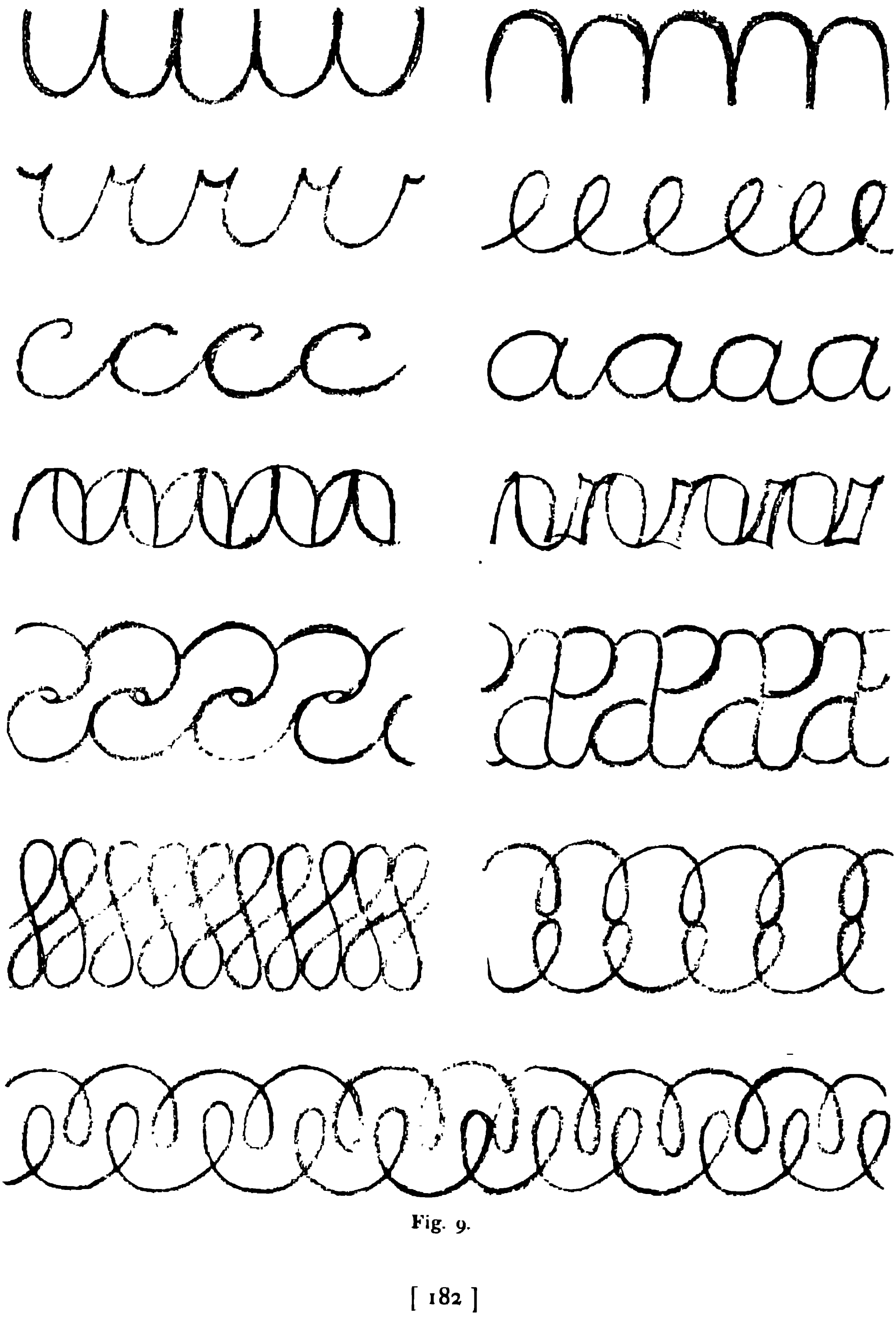


Fig. 9.

even good-quality news-sheet can be used when nothing else is available. It is by no means agreed whether it is better to allow children to work between lines, such as those made by folding their paper, or to encourage them to work without them from the beginning. Working without any lines or creases is probably the better way; it will give the child additional freedom and ultimately enable him to work with a sureness and independence which will also help both his painting and his writing. It is obvious that at first the rhythm lines of his pattern will not be straight and that the whole page may have a somewhat uncontrolled appearance, but it is most important that we should not criticize this or even show a critical attitude towards it. It cannot be stressed too often that children's work must not be judged by adult standards of perfection. Indeed, if we ourselves practise a line or two of rhythmic pattern on large-size paper we shall see that it is not so easy as it looks; a considerable amount of muscular control and mental poise is necessary to keep the lines straight, to reverse or alternate the pattern in the second line and dovetail it into the first. In this way we shall appreciate the skill with which quite young children execute their patterns, though this is not in itself of primary importance, since the real beauty of their work lies in their feeling for related rhythmic forms, their invention and their rich and lovely sense of colour. If a child has been brought up to work on lined paper and he is in a timid state, it would be wiser first to increase his confidence by making him do direct painting with a large brush. Gradually he will cease to depend on the lines altogether, and this will be the time to give them up. If we can help the child to draw his pattern swiftly and with sureness, he will find his work absorbing and emotionally satisfying, and we may have laid the foundation for both good calligraphy and good draughtsmanship in later years.

There are several ways in which we can do this: (1) If the child is working at a desk, table, or easel, he should stand up or sit at a little distance away. If he is working on the floor, he may squat or kneel. This has two advantages: (*a*) In order to get the maximum amount of freedom and swiftness into his brush strokes, he should use his whole arm from the shoulder. Movement which is confined to the wrist will lead to short, jerky strokes. If, therefore, he is at a little distance from his work, he is more likely to draw with the whole arm, especially if he is made to hold his chalk or brush nearer the middle rather than at the end. (*b*) By being farther off from his pattern he will be able to see it and give it his consideration *as a whole*.

(2) When the child begins to draw his pattern, he should begin at the top left-hand corner and "write" one line at a time. He should try to make the top of his first line touch the top edge of the paper, this will help him to keep fairly straight.

(3) When he does his second line, he must try to make his units fit the line above as he wants. Either they must touch the bottom of the line above or they must fit into the spaces between the units above, each time completing the space-shape as required (Fig. 10). It will help him to keep his rhythms even and straight if we tell him to keep his eye not on the line he is drawing but

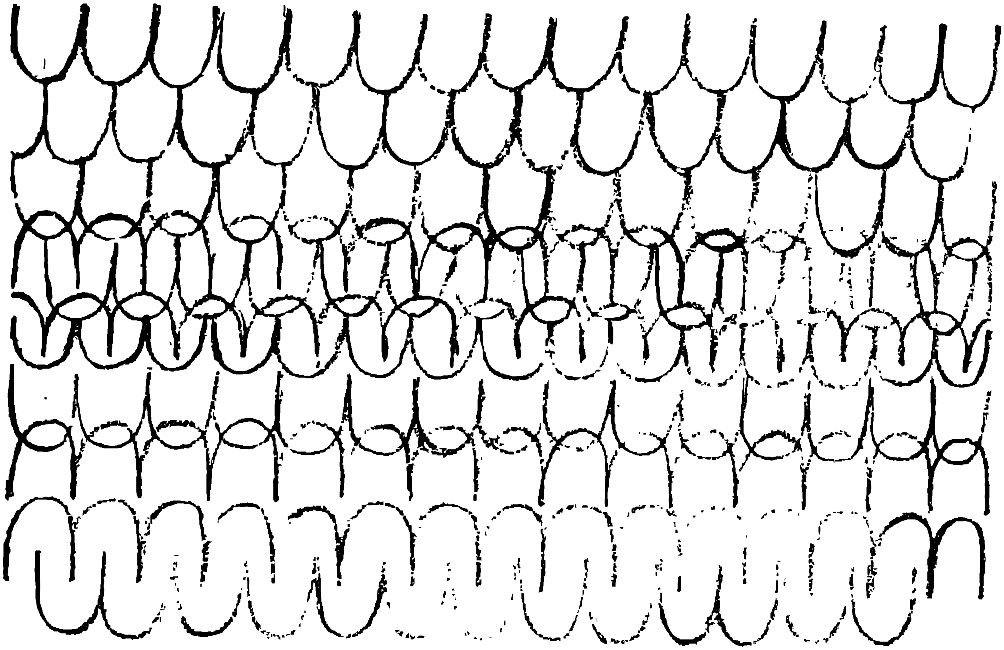


Fig. 10.

on the spot on the paper that he wants to reach next, much as the cricketer keeps his eye on the ball. Sometimes, too, he may practise a line or two with his eyes shut. This will help him to feel the rhythm in himself and to get the swing of it into his arm. The character of a pattern depends just as much on the spaces that are between the lines or on those shapes that occur when one line of pattern is superimposed upon another, as upon the linear arrangement of the units themselves. While he is writing his pattern, we shall tell the child to watch the spaces as he paints the shapes; unconsciously he will gradually become aware of the subtleties of the rhythm which is set up by the combination of line and space in his pattern.

As soon as the pattern is drawn out, he may begin to fill in with colour; this will help him even more to realize the significance of the relation between lines and spaces. If the children are beginners, in order to simplify the problem it is sometimes wise to suggest that they should use only two colours. If they have drawn the pattern directly with a brush in one colour, they may choose another colour for filling in the spaces which will look well with the first.

The limitation of their colours may be a disappointment to them, but they are usually delighted to find how effective their completed patterns look when only two colours have been used. The completion of the pattern should be done line by line; one stage being considered at a time, before the next one is begun, so that the pattern is thought of as a whole. When one or two 2-colour patterns have been painted, a third colour may be added if the child wishes. If he has no idea, we may sug-

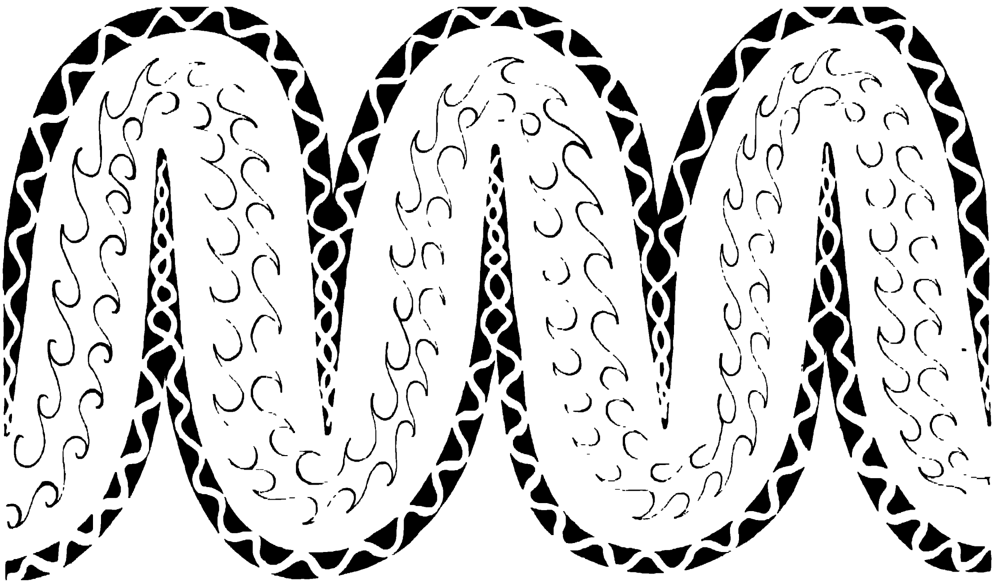


Fig. 11.

gest something like a dark spot, either black, brown, or dark blue, for instance, or a pale spot if the paper has been covered all over with dark colours. This should be repeated all over the pattern until it is complete, and will often give the pattern a lively quality. If the spot is large and heavy in colour, it will appear to " jump " off the page, making the pattern restless; only experience will teach us how to avoid this. From time to time all the patterns should be pinned up or arranged conveniently so that they may be seen at a distance. Supposing a strong black shape has been painted in the middle of a bright-yellow patch of about the same area, and that this is repeated all over the pattern; from a distance, or with half-shut eyes, the children will soon see what is wrong. The contrast of lights and darks is too violent, and we may tell them that if the dark shape is broken up by dots or checks or some other small pattern in white, it will look less heavy and will " jump " less. Two-dimensioned patterns which do not remain flat are extremely disturbing; in short, the " movement " of a pattern should be controlled and should be two-dimensional only. Loud, jazzy patterns so much in vogue today are those in which the tone values are wrong and the movement jumpy and disturbing.

As the child has learned to play with the pattern forms and rhythms, so he will experiment with colour, finding his own ways of decorating surfaces with lines, checks, or dots. Once he is fairly started off he will only need occasional help or suggestion from us. When a large bold pattern has been drawn with a big brush or chalk, the texture of the pattern may be varied by using a small brush, pen, or pencil and drawing a little pattern inside the lines or shapes of the main design (Fig. 11).

When he is familiar with the use of simple rhythmic forms, such as the zig-

zag or wave, the older child may turn to natural objects for the inspiration of his pattern motif. In the leaf or the crystal, the sea-shell or the shadow, he will find the motif for his design. If he has had a good training in abstract pattern-making, he will know that the movement of his pattern will depend on the arrangement of his leaf, for example, which, as he interlocks it, reverses it, or superimposes it, will become disassociated from the tree and from its original form by the time the pattern is finished. The natural object will often be reduced to an abstract shape. It is not the object but its ultimate abstraction which forms the basis and movement of the pattern.

Pattern and Calligraphy

It will be seen that pattern and calligraphy are closely related to one another. As well as being easily legible, the written page should present the pleasing appearance of a good all-over pattern. In *Writing and Writing Patterns,* by Marion Richardson, of which some mention has already been made, the whole subject has been most originally and comprehensively dealt with. In spite of this, however, although many teachers are familiar with the name "writing patterns", and are able to use them properly, there are those who do not understand their application either to writing or pattern in relation to the mental growth of the child. It is essential that every teacher who attempts to correlate pattern and writing should possess Miss Richardson's five books of copies, together with the two sets of cards and the *Teachers' Book.* No doubt something can be picked up by random selections from one or two of the books or by seeing a few examples of writing patterns and making a good guess at the rest, but the most important part of Marion Richardson's teaching may be missed by such haphazard methods.

We may think of the child's education as an ascent of a hill on which we have arranged a series of steps of different sizes which will enable him to climb the hill during his years of childhood and adolescence. If he is a normal healthy child, he should always be moving forward—not, however, at a regular pace, for the speed of the ascent depends on each individual. Sometimes he will be climbing the steps slowly, pausing for breath, as it were, and sometimes he will advance rapidly, almost bounding up them. In the early stages we shall notice that he can only climb the shallow steps, and we shall not expect him to climb up the steeper steps of later stages. By our teaching we shall condition him physically and mentally to approach each flight of steps with confidence, and to climb them with unconscious ease, because they are exactly the right size for him.

At the end of Marion Richardson's *Teachers' Book* there is a collection of reproductions of writing and patterns illustrating a process of growth and development in children from their earliest scribbling patterns at four and a half to the formed handwriting of boys and girls of university age.

Other Approaches to Pattern-making

Pattern-making may also be approached in various other ways: the potato-cut print, the built-up pattern, the stencil or mask pattern, and the

lino-block print. Of these the potato cut is by far the most suitable for Junior children. Patterns made by means of a paper-mask or lino-block print are more suitable during the secondary stage.

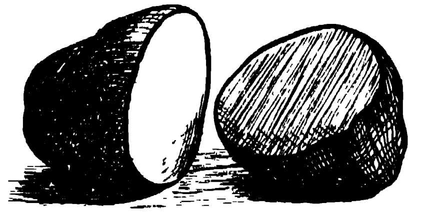


Fig. 12.

Potato Cutting and Printing

This is a simple method of producing a pattern and may be introduced quite early in the Junior School, where its use will help the child to understand pattern-making; it is also a good introduction to relief printing.

The potato should first be cut in halves at right angles to its longest axis by the teacher, because it must be cut swiftly with a sharp knife (Fig. 12). Unless the surface is perfectly level, the potato will not print evenly. Without any further cutting, one half of the potato may now be used for printing. The flat surface is painted over evenly with any fairly strong colour that the child likes—red, black, dark blue, or yellow ochre. Chrome or lemon-yellow will not do for beginners, as the pattern will not show clearly if light tones are used on light-coloured paper. Powder colours are far more suitable than the thin colour out of water-colour boxes. If too much paint is used, it will be squeezed round the outside edges of the potato and will of course spoil the impression. Now the potato " block " is placed face downwards at the top left-hand corner of the paper so that the side of the block touches the left edge of the paper and the top touches the top edge. A light, even pressure is all that is required to obtain the impression. Before the next impression is made, the block must be repainted and the child should be told that this must be done *every* time before a print can be made. It is wise, too, to insist on the same colour being used throughout the design until the child has gained some experience. When the second impression is made, it must again touch the top edge of the paper and the left side of the block must touch, but not overlap, the edge of the first impression (Fig. 13). The ultimate rhythm of the pattern will depend on the accuracy with which each unit is related to the next; therefore it is important to teach children to keep the first line straight by making each print touch the top edge of the paper. If no guiding rule is given, the first line of the pattern will often curve away from the top downwards, and this will disorganize the arrangement of the pattern later on.

The child should repeat the print five or six times in the first row, but not more. His efforts can only be sustained for a short while; if he prints the first line the whole length of his paper, he will tend to get more untidy and in-

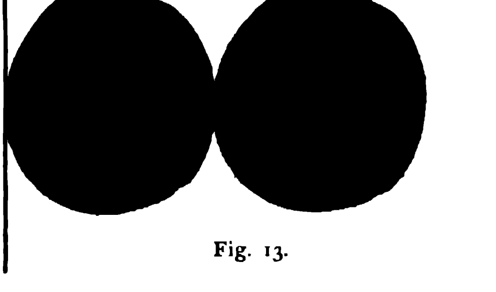


Fig. 13.

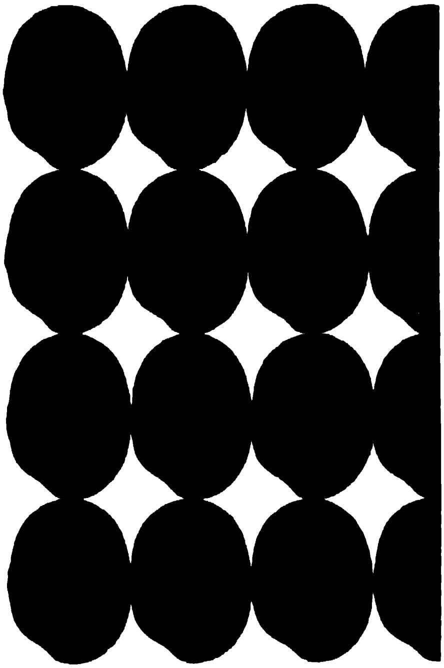


Fig. 14

accurate as he goes along. Also he will like to see the results of his work quickly; he will be able to do this if he prints four short lines which will make a small but complete block of the pattern (Fig. 14). The second line of the pattern begins in the same way as the first, except that now each print, as well as touching the one before, must also touch the bottom of the print, exactly above it.

Young children are not likely to be perfectly accurate about this; patience and muscular control beyond their means are needed. However, they will soon realize that the rhythm of the pattern is dependent on some degree of accuracy, and they will see, too, that the shapes left between the prints (which depend on the accurate placing of the block) form an important part of the whole pattern. It would be quite wrong to fuss over untidy printing. It is better to limit to an even smaller pattern those children who find it difficult to be careful, three impressions each way, for example, so that they have to do only nine prints in all to see the effects of their labour.

When the first all-over pattern has been done, the same block may be used again to make a different pattern—this time an alternate one. The first line is printed as before, but in the second line the unit is moved half to the right. Now each block, as well as touching its fellow on the left, must also fit between the two blocks above and touch them both (Fig. 15). This pattern may be repeated in the same way as the first. With a small group of children these two patterns may easily be completed in one lesson. In the following lesson the children may experiment by cutting the sides of the potato so that the whole shape of the printing block is altered (Fig. 16).

A simple square is a good shape to start with. The children can slice off the sides of the potato themselves,

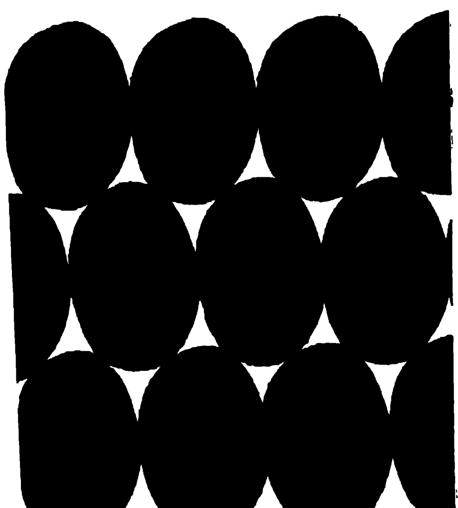


Fig. 15.

using the large blade of a penkife. This should first be printed as a diamond shape, following the first scheme given (see Fig. 14). After this the block may be used as a square; in this case a chequered pattern is produced. The first two lines are printed at the same time, otherwise it is difficult to judge the space between the squares (Fig. 17). In this pattern there is one coloured square and one white square alternately in each line. Again let the children keep the line of diamonds or squares straight by touching the edge of the paper when printing the first row.

These patterns are improved if they are printed uniformly in the same colour, and the white squares are decorated with brushwork afterwards. When the pattern is dry, we may suggest a few suitable ways of painting the white squares: the initial letter of the child's name or a combination of letters may be painted in each square, or some formal shape suggesting a flower, a star, a cross, or a circle, etc.

The children should be quite free to choose what they will do, and what colour or colours they will use. Some will use one colour throughout, while others will wish to mix as many different colours as possible, painting a differently coloured star or flower in each square or in each row of squares. These additions with the brush must

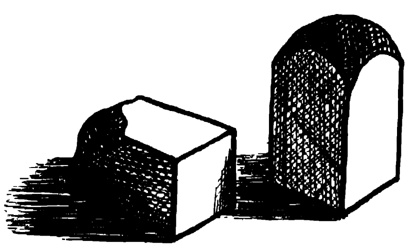


Fig. 16.

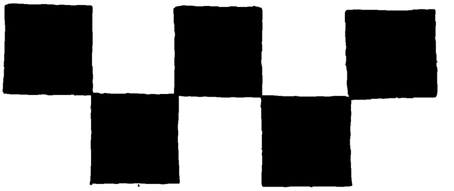


Fig 17.

be purely formal and in no way naturalistic; a miniature landscape, for example, however well it might be painted, would be quite out of place here.

While the children choose what they will do, we may learn more ourselves by watching them. We shall see which of them is adventurous and which timid, how they use their colour, and how far they realize what sort of motif is suitable for a pattern of this kind. Before the end of this lesson the children should be encouraged to cut more of the square block away, perhaps by cutting it in halves first, and to experiment with the new shapes. They will soon find out for themselves what happens if too much of it is cut away, because the little scraps that are left are awkward to handle and will be difficult to arrange into a pattern.

Next the actual surface of a potato block may be cut with a penknife or lino-cutting tool such as a gouge. A channel must be cut across the surface of the block; this may be straight or wavy, but it must extend right across, because the movement of the new pattern will be made by this (Fig. 18). This time, when the block is painted the strip that has been cut out will not print and will appear white in the pattern. This is the child's introduction to relief printing. When this block has been printed as a straightforward repeat, it will be seen that the move-

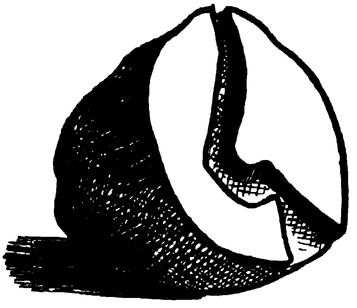


Fig. 18.

ment has been formed by the white line running through the pattern (Fig. 19). As before, the pattern may be varied by the arrangement of the block. When this stage has been reached, each child will be able to practise printing and by making experiments in cutting and arranging the block develop his own technique in the craft. The edges of the block may be serrated or cut into, but the essential movement of the pattern will depend on one at least of the white lines (the part of the block that is cut away) running right through the block. Figs. 20, 21, and 22 show three distinct patterns which have been made with the same block by placing it differently each time. If only a piece is cut out of the middle of the block and does not extend to the edges, the pattern remains "spotted" and cannot be made to flow (Fig. 23). It will be

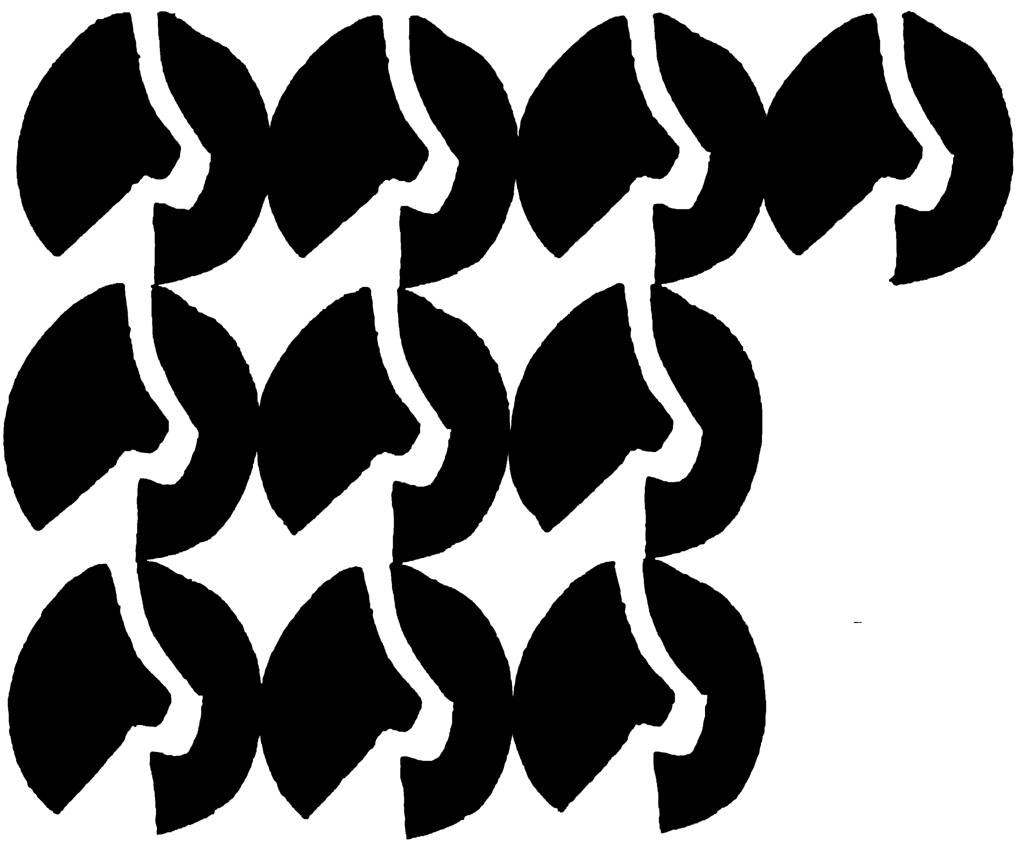


Fig. 19.

found that the number of possible arrangements is limited.

When children become proficient at cutting and printing potato-blocks, they will find that painting the block with a brush each time is a tedious method. A pad of felt or similar material cut to fit an old tin lid and soaked with powder colour or, better still, aniline dye will be more useful. The block is simply pressed face down on to the pad between each printing.

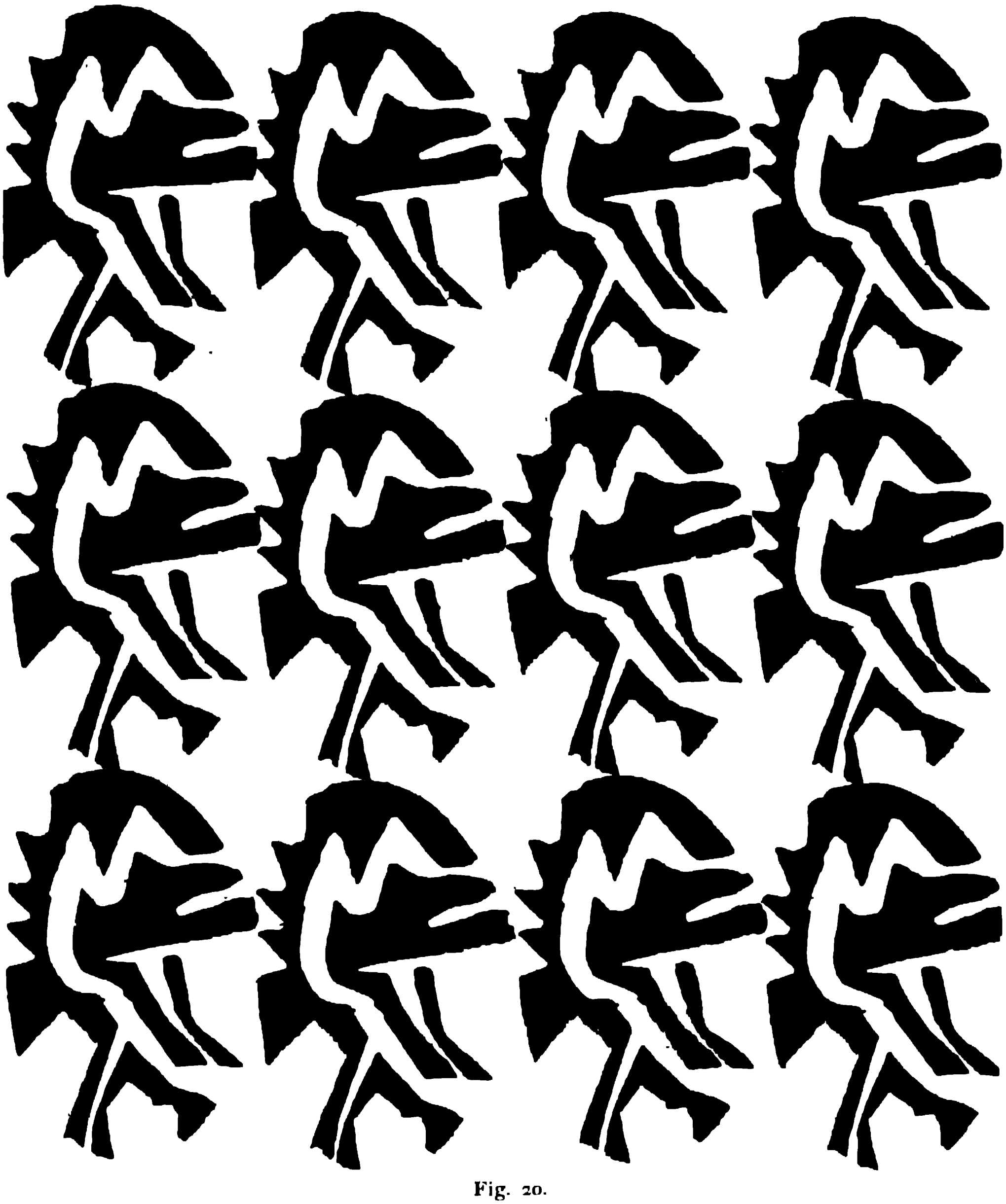


Fig. 20.

This is extremely convenient when a large surface is being printed in one lesson. With all block printing children are apt to think that the cutting of the block is more important than the printing. This idea should be discouraged. No matter how well a block has been cut, nor how ingeniously it has been arranged to make the pattern, the final result will be spoiled if the printing is careless. Printing can be a satisfying occupation in itself, and here it is a part of the whole pattern-making process; neither cutting nor printing should be thought of separately. The mechanical perfection of the machine-printed end-paper or fabric is not desirable, even if it were possible,

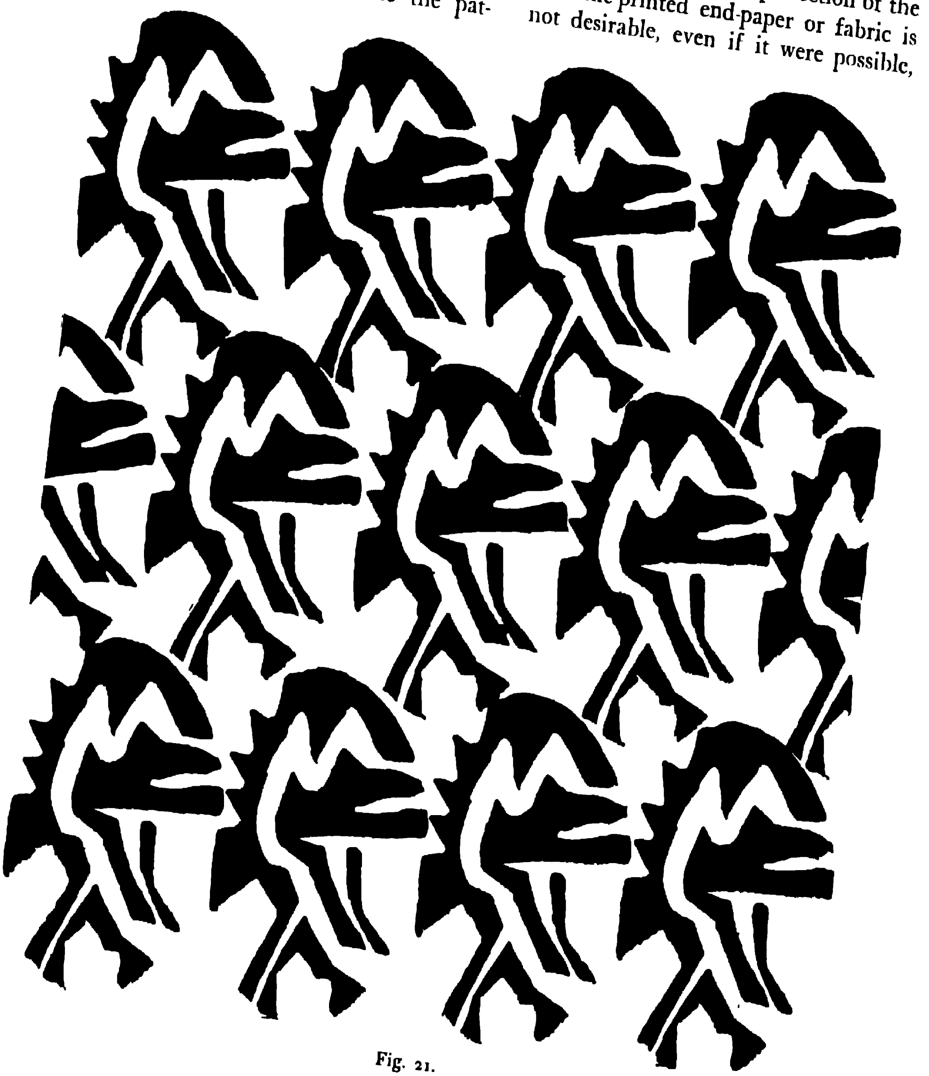
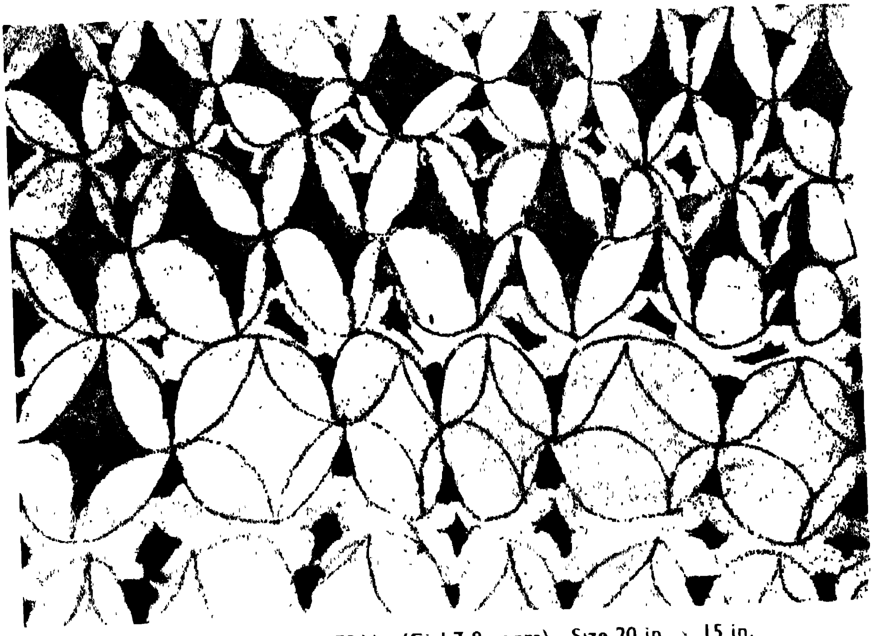
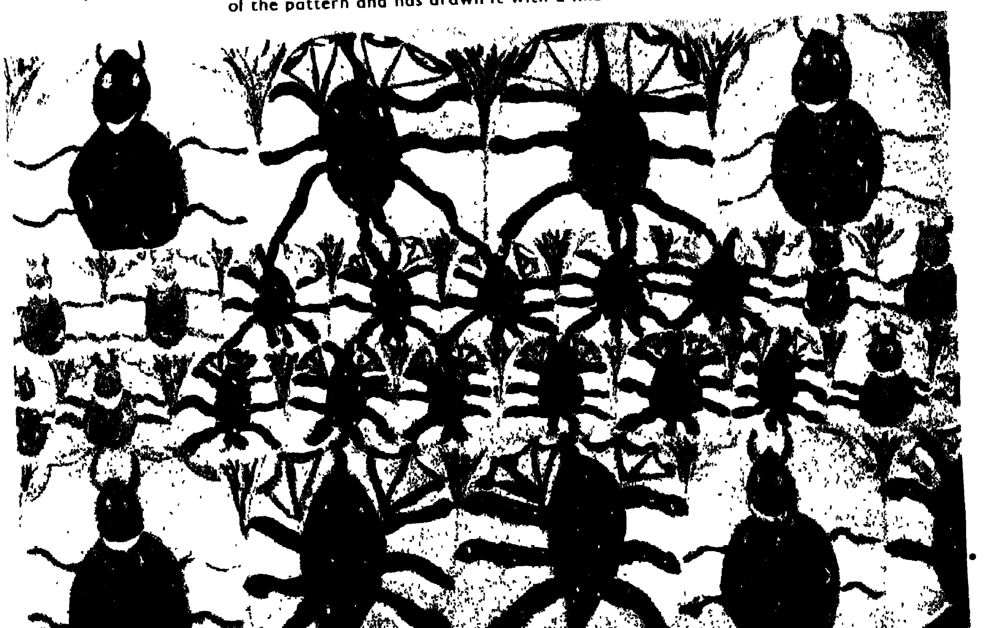


Fig. 21.



(*a*) WRITING PATTERN (Girl 7-8 years) Size 20 in. × 15 in.

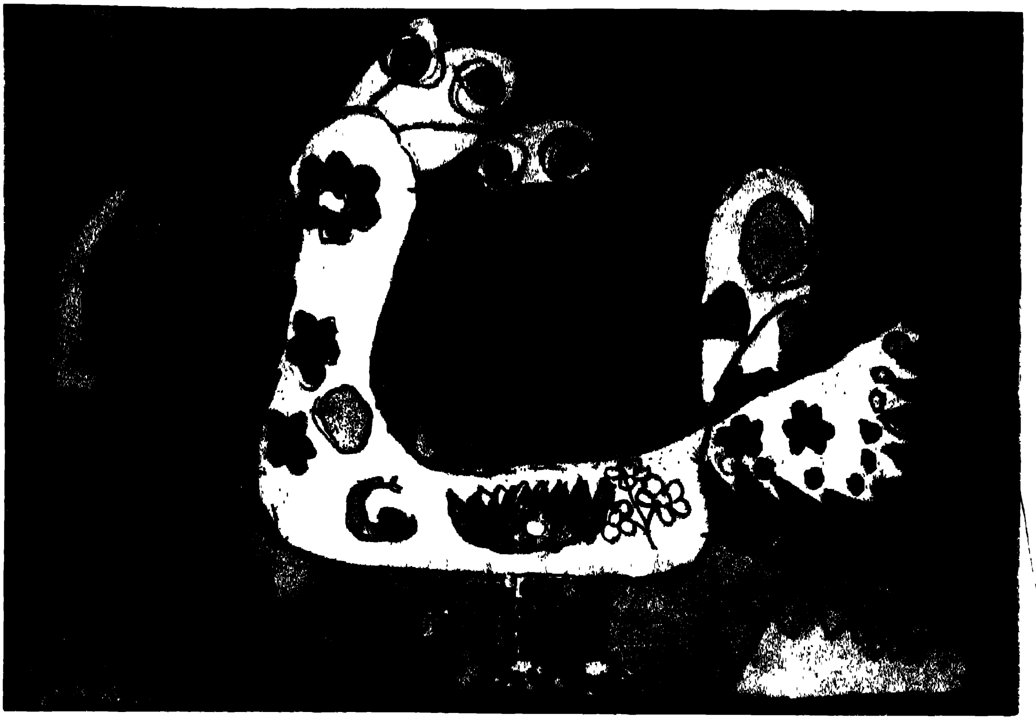
The pattern is made up by inverting and alternating U shapes, the child has felt the rhythmic swing of the pattern and has drawn it with a fine sensitive line.



(*b*) INSECT PATTERN (Boy 11 years) Size 30 in. × 20 in.

The beetles in the pattern are painted in black, scarlet, gold (gold paint) and pale green. The idea is most original and the whole effect extremely rich.

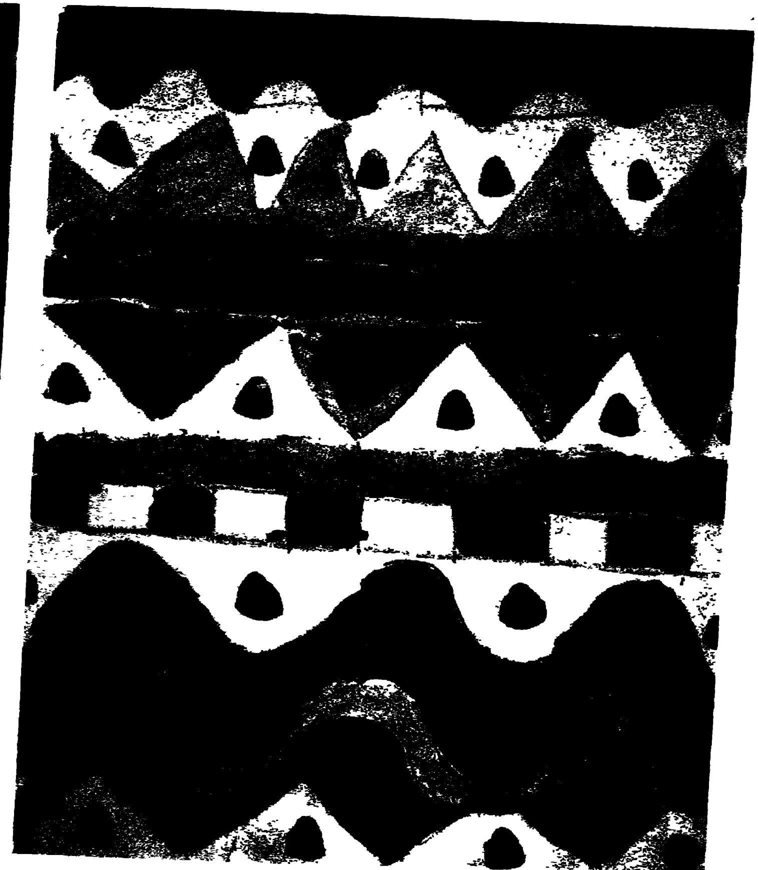
PLATE VI



(*a*) IMAGINARY BIRD (Boy 7 years) Size 18 in. × 12 in.

(*b*) PATTERN "Taking a Line for a Walk" Stage 2 (Girl 8½ years) Size 15 in. × 10 in.

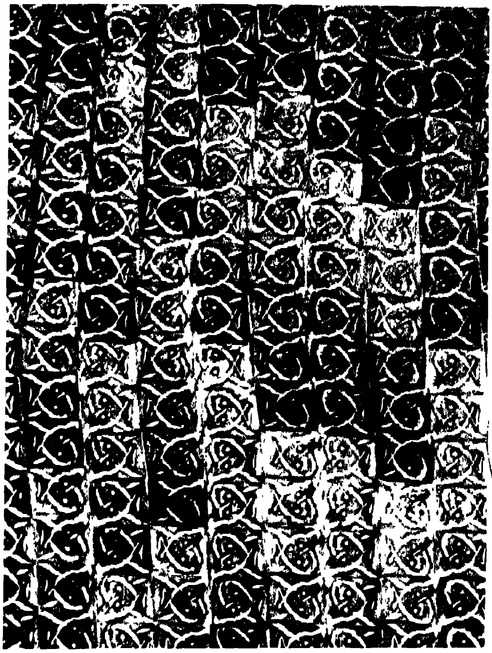
(*a*) PICTURE OF MYSELF (Girl 6 years) Size 18½ in. × 13½ in.



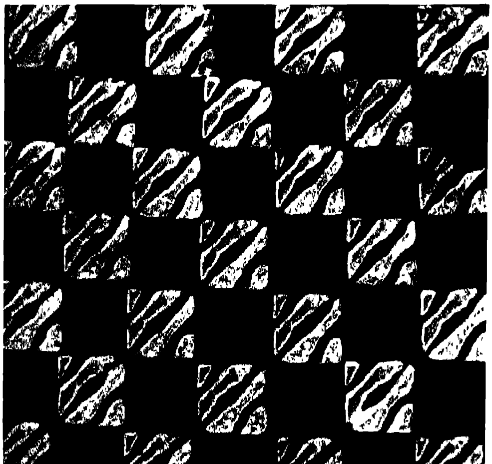
(*b*) A FIRST PATTERN (Girl 6 years) Size 20 in. × 14½ in.
Later examples of this child's work may be seen on Plates XII, XIII (*b*) and XVIII.

PLATE VIII

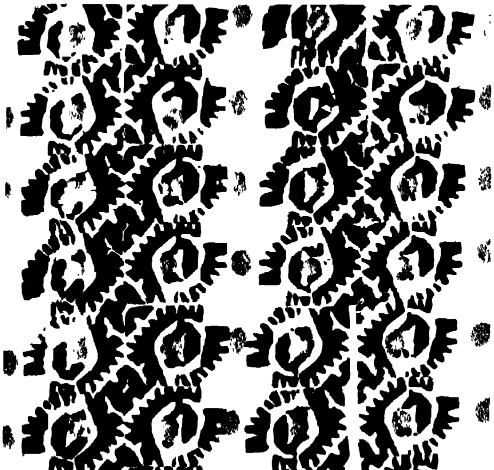
(*a*) CHRISTMAS CARD (Boy 6 years)
Size 9 in. × 6½ in.
Drawn in coloured chalk.



(*b*) A FIRST POTATO CUT (Girl 9 years)
Size 19½ in. × 14½ in.
This pattern was cut and printed in one lesson—about one and a quarter hours.



(*c*) POTATO CUT PATTERN (Boy 11 years)
Size 9 in. × 6¾ in.
Printed for book-jacket or end-paper.



(*d*) POTATO CUT PATTERN (Girl 12 years)
Size 18 in. × 10 in.
The main design is printed in black, the spots in scarlet.

for part of the charm of materials which have been printed by hand lies in the variety of texture caused by the irregularity of the hand pressure.

Children sometimes need help with the actual cutting. Well-defined, clean-cut edges are necessary if the pattern is to print clearly. Whether he is using a penknife or gouge, the child should sit down with both hands resting on the desk. This will help him to cut steadily with one hand while holding the potato firmly with the other and turning it when necessary. To avoid cutting himself, he should be told to cut *away* from his other hand and not towards it. If he stands up to cut, he will inevitably make shaky, ragged lines which he will then try to improve by picking at them with the point of his knife; this will only make matters worse.

The groove may first be drawn on the surface with the knife; then the blade is sloped and a V-section channel

Fig. 22.

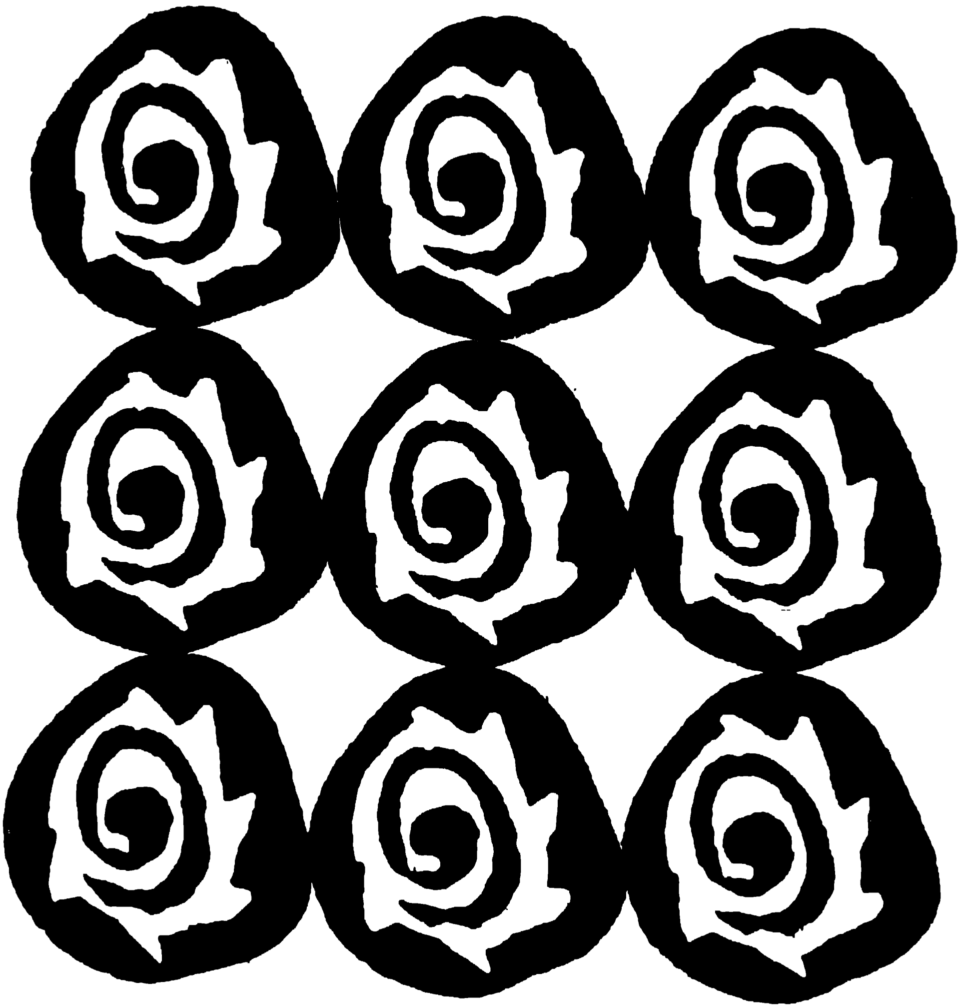


Fig. 23.

is cut; this can be removed in pieces until the groove is clear (see Fig. 18). The depth of a groove must be about equal to its width. Very shallow grooves will not print white, as the ink or paint will run into them. Both boys and girls will enjoy the almost "dental" exercises involved in removing small sections of the potato neatly without making the surface edges of the groove ragged.

When potatoes are scarce, experiments may be made with carrots, parsnips, etc. Very old soft potatoes or the first new ones are difficult to handle.

CHAPTER FIVE

SETTING THE SUBJECT

THERE are many aspects to the question of suitable matter for picture-making, but perhaps the first thing to consider is how far it is necessary to set any subjects at all. Generally it is wiser to leave children to work out their own ideas without interference from us. The more personal and individual their work, the better it will be, and a corresponding benefit will have been derived from its production. As to the amount of help that we give the child whilst he is making his picture, this will depend on his mental age, on his background and the kind of progress he is making. The teacher's function is to clarify the *child's original ideas,* and to help him to visualize these so that he may express them on paper. Suggestions should never be forced upon him which would destroy his own ideas, for it is not the *idea* which is of importance in itself, but the fact that it has been through the child's mind first and has re-emerged bearing something of his inner personality. So long as we strive for the individual element in the child's work, we shall not make the mistake of attempting to substitute either our own ideas or the second-hand ideas of magazines, cartoons, and picture-books.

It is suggested, then, that subjects should only be set for special purposes and never without a good deal of preliminary thought.

A subject may have to be set to stimulate the imagination when this is necessary or when the occasion demands it. Here we must remember that children are often very "contra-suggestible." They do not always use the subjects we have thought of for them, although they may come to a lesson apparently empty of ideas and may even clamour for suggestions. They will often reject the subjects we have suggested in favour of some of their own. These may seem to us to be dull when compared with our own adult ideas, but even if it is the same "ship," "house," or "motor-bus" that we have seen before, it is a healthy sign that the children are not entirely dependent upon us and show originality. Indirectly, our suggestions may be of use in bringing ideas to the surface of the child's mind, and when this happens he should be encouraged to continue to work on the subject of his choice.

Sometimes a subject may have to be set at the beginning of a new term; after a short holiday, or at any time when both teacher and children are new to one another; or when some special occasion such as a play or Parents' Day is over and there is a feeling of reaction.

Children who have been working individually or in groups for some time like to be given a piece of work which they can do all together for a change. Where there are difficulties of discipline,

a set subject will have a steadying effect and will give the children a sense of security.

The child's world of fairies and other supernatural beings is an obvious source of inspiration if approached freshly without reference to the multitude of poorly illustrated picture-books with their garbled versions of our traditional rhymes and tales. The most vital imaginative stimulus for young children lies, however, not in fantasy but rather in the factual world around them. This point has been well put by Evelyn Gibbs in her book *The Teaching of Art in Schools.* She says "By imagination we mean not only fantasy, but also robust memories of everyday life; these are the real stimulus to imagination and form the inspiration for imaginative drawings." The child's mind is richly stored with experiences of his daily life, both emotional and visual. The caverns of his memory may, however, like Aladdin's cave, be closely sealed so that he cannot explore them himself without some help from us, or they may be filled with forms which are too shadowy and vague for him to catch hold of and put on paper (he cannot "see inside his head"). Alternatively, he may be confused by the quantity and richness of the material he possesses, so that, instead of selecting only what is essential, he attempts a panoramic view filled with little people and objects, and far beyond his powers of execution.

The main purpose of suggesting a subject, then, is to give the initial impulse which will enable the child to start a picture. Scenes from everyday life, from history, literature, the Bible, poetry, fairy-tales, and nursery rhymes may all be used visually, poetically, romantically, or dramatically, but in each case the subject chosen must be brought into a small concentrated visual focus.

The art of young children centres round themselves, their home and immediate family circle. Among the five- and six-year-olds (and even the sevens) subjects such as "My Mum," "My Dad," "Our House" are constantly found, and very little suggestion is needed from the teacher. Little boys with their strongly mechanical interests begin drawing railway engines, motors, ships, cranes, and aeroplanes at a very early age, while girls tend to elaborate the "house" theme, adding curtains to the windows, flowers to the garden, and so forth. As children grow older and the range of their experiences both actual and imaginative increases, the variety of the subjects they like to choose corresponds with the widening circle of their interests. Subjects become more general and less home-centred and both the choice of subject and its treatment become more personal. Romantic subjects which express some part of the child's fantasy life are valuable—the Fireman, the Engine Driver, the Fighter Pilot, the Milkman, the Postman, or the Nurse are all characters with whom the child may identify himself at some time. (The Film Star and the Crinoline Lady are perhaps best left unsuggested, as they evoke the second-hand material of the cinema poster or the embroidery transfer with its wealth of hollyhock and crazy paving. If the fashion plate or "old-fashioned lady" appear unelicited, however, it is wise to let these fantasy subjects work themselves out rather than attempt to prevent them.)

It is important that whatever kind of

subject is set should not be beyond the child's capacities. Even if the subject is part of his daily life or something which he has experienced imaginatively, it may still be too difficult for him to visualize clearly for himself. Children's suggestions are often vague and indefinite, they need the kind of help which will bring the essential image clearly into focus. For instance, a girl may want to paint a picture called "People Going Shopping": she starts off enthusiastically enough, but only succeeds in making a few vague lines and finally draws one or two very tiny people floating in space in the middle of the paper. She is naturally discouraged and disappointed. Her head is full of all sorts of interesting shopping incidents, but they are jumbled up together, and not all of them are visually translatable, for some of them are sounds and smells. This is the moment when she needs help. A good suggestion will be that she should draw only *one* lady going shopping, Mum or Grannie, and that she should be drawn as large as possible, the longest way of the paper, so that her hat is almost at the top of the paper and her feet at the bottom. This will make it much easier to paint her, and more fun (it requires much more skill to paint very small things), because she will be able to decorate the lady's clothes and draw her shopping-basket. The shops can be fitted into the background after the lady has been painted; here again only one or two of the simplest and most colourful shops should be selected—the greengrocer with his piles of fruit, or the draper's window with bales of coloured stuff.

These and any other suggestions should only be made if the child is uncertain what to do next, and they should be simplified so that they seem easy to the child and well within his powers. But even if children have learned to visualize subjects like the above clearly and easily, only a few of them will be able to paint pictures of such difficult subjects as "Morning Prayers at School" or "A Roman Chariot Race"; they may, however, be able to make excellent and expressive drawings of such subjects, with details which might be obliterated in painting.

Nursery rhymes provide an excellent fund of subjects if they are treated in a robust and "contemporary" manner. The pseudo-mediæval-cum-Elizabethan fancy dress of the cheap nursery-rhyme book is an affront to our splendid inheritance of rhymes and strips them of their vigour. These rhymes, which date from various periods, can be usefully employed in the study of costume, in conjunction with English or history, but this is only suitable for older children.

Only some rhymes are suitable for picture-making, and it is necessary to select them carefully. "Little Boy Blue" and "Yankee Doodle Comes to Town" are full of possibilities, also "There was an Old Woman who Lived in a Shoe". "Dickory, Dickory Dock" is unsuitable: it is much more easily translated into action than visual imagery.

On the other hand, if the verse is to be written out and the page decorated with the pen, almost any rhyme can be used. "I had a Little Nut-tree" would be more suitable for a rhyme-sheet than for a picture. "Hey Diddle Diddle, the Cat and the Fiddle," which is rather a difficult rhyme to illustrate in picture form, would make a good

frieze decoration or a border pattern of cats, fiddles, dog, dish and spoon.

Rhymes in which a number of incidents take place, such as " Mary had a Little Lamb " or " The House that Jack Built," or poems like " The Pied Piper," are most suitable for decorative friezes which will go round the walls of a room. In " The Pied Piper," or in a rhyme like " Oranges and Lemons," each child in the class can contribute one figure or more to the procession of children; the most telling pictorial line from the latter is, of course, " Here comes a candle to light you to bed," and it is around this part of the rhyme that the picture may be built up, while the bells may be used as a border decoration to the whole frieze.

Many nursery rhymes will need the selective help that has been mentioned. For example, such a rhyme as:

> " *The grand old Duke of York,*
> *He had ten thousand men—*
> *He marched them up to the top of the hill*
> *And he marched them down again,*
> *And when they were up they were up,*
> *And when they were down they were down,*
> *And when they were only half-way up*
> *They were neither up nor down,*"

will be very good for small boys to paint, so long as it is treated as a portrait picture of the Grand Old Duke; the emphasis should be laid on him and his colourful uniform while the ten thousand men should be treated as subsidiary and put in the background of the picture. The Grand Old Duke should be drawn as large as the paper will allow, and the possibilities of full-dress uniform discussed with the class, especially decorative accessories such as cocked hats, gold braid, epaulettes, sash, sword, medals and decorations (possibly one or two large and shining stars), tail-coat, breeches, top-boots, spurs, etc. In fact, the Duke must look a very fine fellow indeed, and the larger he is drawn the easier it will be for the children to paint his uniform and decorations nicely and get the maximum of enjoyment out of their lesson. When the Duke has been planned out—that is, drawn or partly painted—there will be spaces on either side of him in which the hill or range of hills, with one much higher and more prominent, may be drawn in the background of the picture. Some of the ten thousand men will be able to march up and down on the largest hill, and many children will quickly find out the conventional ways for expressing a crowd of men marching rank upon rank, but a few may need to have it suggested to them that if the first row of four men marching are drawn, the rest of the ranks may be indicated by being simply suggestions of heads and rifles or swords, and then they will soon look like an army and not be at all difficult to draw. If the child is left to struggle alone with the awful problem of drawing ten thousand men, he will soon become disheartened and may easily miss the pictorial opportunities that lie in the rhyme.

Many of the very familiar rhymes have been used so often that they have become hackneyed and we all have preconceived pictorial ideas of the illustrations for them. They can be used over and over again, provided they are ap-

proached freshly by the teacher. It is the teacher who must think out new ways of approach so that her presentation of the subject may be lively and inspired.

"Hush-a-bye, Baby" is just such a rhyme and is familiar to nearly all children. Pictures of babies in cradles with gaily-coloured shawls present no difficulty to little girls, and this part of the picture should be drawn first. The children may be told that the cradle must be fairly big because it is the most important part of the picture, and because we shall all want to see the baby. Then they must decide whether it is to rest in the forked branches of the tree or be suspended from the boughs with coloured cords, whether it will tilt slightly or hang straight, and whether the wind has begun to blow or not. All these important decisions must be made by the child, the teacher only suggesting the pictorial possibilities that lie hidden in the rhyme. It is for the children to choose which of these will express most nearly what they themselves feel it should be. When the cradle has been completed, the rest of the space can be filled up with an irregular decorative pattern of leaves, bare branches, or simple blossoms like chestnut "candles" with the distinctive leaf—the variety is endless. The background may be left unpainted, so that the natural colour of the paper takes the place of the sky, or else the sky should be painted in first and allowed to dry before the leaves and branches are begun. A general discussion on skies and wind will help each child to decide for himself what kind of sky he wants—a clear sky with clouds scudding across, a dark, windy, stormy sky, and so on. Skilled landscape artists often paint their sky background in first and then draw the trees on the top, so that the sky shows through between the leaves. It is foolish to expect comparatively unskilled children to attempt to paint the sky in between the branches, as this is exceedingly difficult. If, on the other hand, they are allowed to paint wet tree-tops on to a wet sky, the paint will all run and the whole picture will be a disappointing mess.

Besides the subjects that have been spoiled for us by poorly illustrated books, there are many which have been used in schools to such an extent that they have become hackneyed and tedious—for instance, Washing Day, Market Day, a Picnic, a Day at the Seaside, or a Day in the Holidays. There is no need to avoid all these, but our approach towards them should be different. They have constantly been presented in a literal way, and the lack of individual feeling and treatment has led to numbers of similar and boring pictures. If a picture of a picnic is merely a factual description of people and objects dotted round a white tablecloth, on grass that is painted in uniform anæmic green, then it is no more interesting than a catalogue. The relation between the objects must be both a satisfactory formal arrangement and one that is emotionally significant to the artist. The subject of the picnic must be so presented that each child feels he is both a spectator and a participant at the feast. To begin with, a more inspiring title might be chosen—"Picnic under the Trees," or "The Scouts Cooked Supper among the Rocks." This, and the way we describe the scene, will help the child to "see" it in his mind with something of the

artist's inner eye; at the same time he must be able to feel himself sitting in the lush grass or among the rocks enjoying the peculiar delights of eating out-of-doors.

While the details of the picture can be discussed by the class, for example the food, the crockery, the different ways that people lie or sit out-of-doors, and what they wear, it is the atmosphere as a whole that is important. The older children might attempt to paint the dappled shade under the trees or a threatening thunderstorm, while younger ones will appreciate the pattern of flowers in field and hedgerow. These things can only be described so that they awaken reciprocal feelings in the children, if we really *feel* the subject ourselves and succeed in "getting it across." If the picture is to be about people, then they must be made the central and dominating part of it, otherwise the picnic-party may become a small white patch in the background of a spacious landscape.

A very generalized subject such as "A Day in the Holidays" should never be set for young children. It will nearly always result in a number of uninspired nondescript pictures; set in this way it is vague as well as confusing. What child can sort out the incident which is most easily translated into visual terms from among all his varied experiences during the holidays? A few children may have some high light upon which they can look back, but many of our town and city children will have spent the time playing about in the back-streets or going to the pictures. On the whole, children like casting their minds forward to the pleasures to come rather than backward to the past. After Christmas, during the hard Winter months, the imagination leaps easily towards the Spring. Then is the time when children of eight or nine will enjoy thinking of the budding leaves and flowered fields. If holiday memories are used, it is better to choose a subject from among the experiences which the children are likely to have had, for instance "Building Sand-castles," "Helping with the Harvest," or "Games in our Street."

Although more varied and individual work is often obtained if the lesson is given in the form of a discussion, the children contributing nearly all the information required for the picture, a description of a set scene can also be used with success. It is a curious fact, however, that both methods seldom work well with the same group of children, those who respond to one will not necessarily produce work of the same quality when the other method is used. It is only by experiment that we can find out which is best suited to any particular group of children. With the first method the children have a far wider choice, they suggest all kinds of ways of making the picture from the chosen subject. The teacher sums up at the end and emphasizes the essentially pictorial elements which arise out of the discussion.

Before beginning the discussion there are two points to remember; first, each child should be ready beforehand with paper and charcoal or brush, to begin drawing as soon as the discussion is over. Next, children who contribute should not be allowed to ramble from the point, wasting time and dissipating the interest in the subject. When all the children are ready, the teacher may begin in this way: "Today we can all feel that Spring will soon come. We

can see the snowdrops already, and (in the country) the rooks are building their nests again. We have all been indoors so much lately that it would be nice to think of the warm days that are coming and to paint a picture called 'Out of Doors in Spring.' First, let us think of all the lovely things that you will put in your picture." Then the children will suggest all kinds of things, and we shall help them by talking about the tenderness of the Spring, the freshness of the colour and the variety of its patterns. "Springtime," we shall say, "is full of patterns. There are patterns of leaves and flowers, of the speckled hen with her brood of chicks around her, speckled eggs and spotted thrush; the pattern of sheep folded on the distant hillside, 'Landscape plotted and pieced—fold, fallow, and plough'; wherever we look there are patterns to help us to make our picture." Although country children will be familiar with these things, they will also take much of their background for granted. They may need our help to "see with the mind's eye" the flat, hilly, mountainous, or arable country with which they are surrounded. Town children, on the other hand, will need a description of some country scene (chosen for its pictorial qualities) of which we have vivid memories ourselves. If this has given us real æsthetic enjoyment, and if we can describe such a scene with sincerity, we shall communicate our feeling to the children, who will respond with delight. Our reward will lie in their lively spontaneous paintings.

While we are describing the Spring, we may tell the children that this is a specially joyous season of the year and invite them to suggest ways in which this can be expressed. "Even the sky," we may add, "with its delicate greeny-blues and little fleecy clouds, reflects this feeling." Here we may perhaps remind them that white must be added to the blue to make the sky pale, for the raw blue straight out of the pot will not give us the kind of colour we have been thinking about.

With an intelligent group of children, the danger lies in too much detail being provided in a very short time. We must encourage the children to do as much of the thinking as possible, but as soon as enough information has been collected for most of the children to make use of, the discussion must be summed up: "Now you won't be able to put in quite *all* the things we have been talking about, so you must choose one or two things that you would like to paint and that you feel will tell us most about the Spring. Remember that it is not only *what* you put in your picture that will make it Spring-like, but the *way* you think about it, and paint it. So try to keep your paint-water and brushes clean, so that your colours may be bright and clear, and let your brush strokes be lively and gay."

The alternative method is to describe a complete scene which has been chosen because it will make a good picture. This description must have been carefully thought out beforehand and the whole scene visualized. If we can acquire something of the painter's "seeing eye," we shall always be looking out for the right kind of subject. The artist whose inspiration comes from contemporary life is always watching for scenes which have an æsthetic significance for him. These subjects are not only found among the

romantic or sentimental scenes generally accepted as suitable for painters, but in more mundane subjects. It may be a mother bathing her baby that holds our attention, or a man in a bowler hat standing in a pool of lamplight drinking tea from a little stall. Some arrangement of light and dark, colours or textures has attracted us and will be stored in the mind for future use. On the daily travel to work, at the week-ends, and on holidays, we shall be looking for such scenes as these, which we can see already completed in terms of a picture, and can describe to the children later. As with every subject, very simple scenes must be used for 7- and 8-year-old children. These can sometimes be dramatized in class to make them more vivid; such a subject as " Policeman Catching a Burglar " might be handled in this way—the children pose for the policeman and burglar as in a tableau, while the teacher describes the rest of the picture. A more complicated subject may be used for older children. Here is a description for children from 10 to 12. "The other day I saw some children picking pears, and I thought I would like to tell you about it. The pear tree was a very tall one, so you will have to turn your paper up longways for the picture. It was a most beautiful tree, and, like all pear trees, it had branches growing off it in curving sweeps, like the water from a fountain. The tree grew on a bombed site. The ground was lumpy and uneven, with clumps of tawny grass bleached by the sun, and willow herb growing wild all over it. But on the tree were ripe pears, and under it and all around there was a crowd of children. They had brought a very long pale-coloured ladder, and this was leaning up against the tree. One boy had already climbed up and was standing nearly at the top of the tree, holding on with one hand and reaching out to pick the pears with the other. We are only used to seeing small things like birds in trees, so this boy looked very big and unusual standing up there. Farther down the tree another boy was sitting on a bough, throwing pears down to the children waiting below; his legs dangled below the branches, and he had red hair, which looked very nice among the green leaves. It was a lovely September day, the sky was a pale blue, like a starling's egg; there were streaks of white cloud floating about, and the children were all jumping up and down excitedly. Some were holding out coats to catch the falling fruit, some were bending down, picking it up. They wore all sorts of differently coloured clothes. This helped to make the scene into a good picture, because the colours of their clothes arranged themselves into a pattern. There were pink jerseys and pink skirts (but not on the same child), pale- and dark-blue skirts, white hair-ribbons and socks, as well as other colours, so that the crowd of children made a sort of chequered pattern. They mostly had their backs turned towards us. Behind the tree stood a row of little houses with dark-green doors. On the edge of the crowd there was a pram and one or two tiny children; three dogs were playing about as well. Although you will draw the pear tree very large, don't forget to leave plenty of room for the children and to make some of them tall, so that you can paint their clothes nicely. Now we can all begin."

If the subject is introduced by means of a title, words full of meaning that

quicken the imagination should be used. For instance, the title "Things that Prowl by Night" helped to produce the lovely and awe-inspiring picture, Plate X. This title in itself is full of mystery and the fearful unknown, and may remind us of Blake's famous lines:

> *"Tyger, Tyger, burning bright*
> *In the forests of the night."*

The young painter has responded magnificently to the poetic suggestion of the words.

The title chosen should not suggest something vague and general but should evoke a clear visual impression. Thus, "Mother" is not as good as "My Own Mum," or "My Mum is Lovely." Again, to the child such a title as "Trees" may only suggest a dim image of a few stunted hawthorns on some suburban common, but there is an immediate imaginative response to such a title as: "The Trees Stood Stately and Tall."

It is obvious that poetic imagery is an excellent stimulus for picture-making. The poetry chosen, however, must be easily understood by the children. The kind of poems that contain abstract or stylized "poetic diction" are quite unsuitable because they do not present a clear visual image in the mind. For example, *The Lake Isle of Innisfree,* by W. B. Yeats, though lovely and lucid in its poetic expression, is neither easily understood nor visualized by junior children. A passage such as—

> *"Nine bean rows will I have there,*
> *a hive for the honey bee,*
> *And live alone in the bee-loud glade"*

though full of objects that may be visualized, is not a purely visual conception. By the time the nine rows of beans and the hum of the bees have been described and fully understood by the children, the poetry will have been lost, and it is doubtful if the children will have any pictorial image in their heads that is worth capturing. A poem like *The Wind,* by James Stephens, on the other hand, needs very little explanation and evokes an immediate visual image—

> *"The wind stood up, and gave a shout;*
> *He whistled on his fingers, and*
>
> *Kicked the withered leaves about,*
> *And thumped the branches with his hand,*
> *And said he'll kill, and kill, and kill;*
> *And so he will! And so he will!"*

A few suitable poems are suggested in the list at the end of the chapter. It is not difficult to find many subjects among poems which will make successful pictures, provided that the teacher's personal poetic preferences are put aside and the poem is chosen especially for its pictorial imagery. Thus it will not always follow that the poems the children are reading and learning in their English lessons will be the ones that they can illustrate in the art lesson.

Sometimes it may be possible to use poems and plays which the child will not be reading until a later stage, if the story is told simply in words he will understand, and passages are carefully chosen which can be easily translated into pictorial terms. Every teacher is

familiar with illustrations or picture postcards depicting sugary little fairies clinging aimlessly to sprays of larch. They spring from a vein of Victorian sentimentality which is false, because it is untrue both to the child's world of fantasy and to the world of traditional folk-lore. The witches, wizards, and hobgoblins of our English forebears were very real people to them, and were more often than not thought of as being life-size. Shakespeare's fairies are touchingly human in their behaviour, there is no whimsical sentimentality about them, while Milton gives us an impressive image of his goblin in *L'Allegro*:

> "*Then lies him down the Lubber Fiend.*
> *And stretch'd out all the Chimney's length,*
> *Basks at the fire his hairy strength.*"

This is the kind of robust fantasy which will stir the child's imagination and give him a clear visual image which he can use in his painting.

In *A Midsummer Night's Dream* and *The Tempest* the fairies and other supernatural beings provide a wealth of material for picture-making. These subjects may be used for the older children of the Junior School, and will provide a good introduction to the Shakespeare they will be reading in the years that follow. For example, the story of the quarrel between Oberon and Titania may be simply told to the children and illustrated by such lines as "over hill, over dale," which suggests the atmosphere and scale of Shakespeare's fairyland.

In Puck's speech beginning:

> "*The king doth keep his revels here tonight*":

we hear how Titania

> " . . . *withholds the loved boy,*
> *Crowns him with flowers and makes him all her joy.*"

From this image a picture can be made. It is followed immediately by another, perhaps less precise but none the less pictorial in character:

> "*And now they never meet in grove or green,*
> *By fountain clear or spangled star-light sheen,*
> *But they do square; that all their elves, for fear*
> *Creep into acorn cups, and hide them there.*"

The relative size of the fairies is suggested by the last line, as in *The Tempest,* when Ariel sings:

> "*Where the bee sucks, there suck I:*
> *In a cowslip's bell I lie,*
> *There I couch when owls do cry.*
> *On the bat's back I do fly . . .*"

We must explain to the children that since Oberon, Titania, and Ariel are all full-sized people in the plays, this change of scale is achieved by painting giant ferns and flowers on the stage, thus diminishing the size of the fairies, so that they look as if they could creep into the acorn cups or cowslip bells. Similarly, when we paint pictures of tiny fairies we shall draw them the size of grown-up people, and enlarge the fountains, flowers, or dewdrops accordingly. If we do not adopt the conventions of the stage we shall find that the

children are drawing acorn cups their actual size, with minute insect-like creatures inside them, that have no resemblance to frightened elves. No one, least of all young children, can draw such tiny figures with success. We may recall Blake's delightful illustration to his poem *Infant Joy* in which mother and babe with an attendant fairy are grouped together inside a large pink flower. The artist has altered the scale of the flower to fit the figures. It follows that, when we describe the activities of giants or monsters we must first consider what will be a suitable scale. The giant will appear enormous only if we make the objects that surround him relatively small, but these must not be so small that the child cannot draw them at all. Giants, too, must be drawn as large as the paper will permit so that their vast size may be used to advantage. It will give the children pleasure if, as well as drawing upon the rich stores of folk-lore and legend, we sometimes invent for them supernatural beings, who can be adapted to ordinary life, and in particular to the child's environment. As an example we may read *The Magic Fishbone*, by Charles Dickens, in which the traditional fairy godmother has been combined perfectly with everyday life in a large family. Or our story may begin in the following way:

"Once upon a time there was a good kind giant who was a Policeman. He was so big that his boots were size 52 and he had to be very careful when he walked about. Often he stood in a park in the middle of the town, and in this way he could see all over the place. He was so tall that the roofs of the houses only reached up to his knees. He could see into people's back gardens. When he was tired he sat down on the top of a nicely rounded hill. One day . . . "

When the story is finished we shall see that the children do draw the giant as large as possible. To some extent the scale that has been chosen will force them into doing this, because unless the giant is a good size, the houses and the surrounding landscape will be too small to be drawn conveniently.

Imaginative subjects such as these are most suitable for children of nine years and over. Their fantasies may include wizards, leprechauns, dragons, mediæval saints, and so forth, whose traditional appearance will have to be described before they can become clear visual images which the child can use in his picture. When he has reached the age at which he will enjoy reading legends and fairy stories to himself, he will be assimilating such information naturally and will be able to make use of it.

List of Subjects

For General Use

5, 6-, AND 7-YEAR-OLDS

Our House.
My Mum is Lovely.
My Dad is Very Big.
My Big Sister.
Walking with My Dad.
Shopping with My Mum.
Our Baby.
Making Sand-castles.
Bedtime Story.
I can Reach up to the Sky.
"As Tall as a Tree, as Small as a Mouse, as Wide as London Bridge."
Bears at the Zoo.
A Stocking for Me!

Father Christmas.
A Christmas Tree.
Toys.
Eating Chips out of a Bag.
A Carpet with a Pattern.

7- TO 8-YEAR-OLDS

The Royal Pram.
Our Baby likes his Bath.
Baby with Toys and a Drum.
Down our Street.
My Dad drives a Steam-roller.
Washing for my Dolly.
My Motor-bus.
A Birthday Cake with Seven Candles.
The Burglar is a Bad Man.
The Coalman.
House and Garden.
Ships.

8- TO 9-YEAR-OLDS

Hiawatha.
The Pirate Chief.
A Battle between Sailing Ships.
Tugs and Barges.
A Nest Full of Eggs.
Caught in a Thunderstorm.
Hands Up!
The Lamplighter.
The Window-cleaner.
The Sweep is a Jolly Man.
Cowboys.
The King has Breakfast.
The Hat Shop.
Choosing a Hat.
Mother Reads to Us.
Watching the Trains.
Family Tea.

9-, 10-, AND 11-YEAR-OLDS

Camping on an Island.
Waiting for the Doctor.
Sailing Boats on a Pond.
Fishing on the River-bank.
Punch and Judy Show.
Circus.
The Ice-cream Man.
The Nightwatchman.
Tyger, Tyger.
The Fireman Climbed in through the Smoke and Flames.
Ballet Dancers.
"Fifteen men on a dead man's chest,
Yo-ho-ho! and a bottle of rum."

PORTRAIT SUBJECTS

7- TO 11-YEAR-OLDS

Policeman.
Fireman.
Fighter Pilot.
Musician.
Cowboy.
Nurse.
Lady at the Hairdresser.
Waitress.
Princess.
Farmer's Wife.
Famous Footballer.
Powerful Queen.
Disagreeable Giant.
Nice Old Fairy.
Jockey.
Very Bad Man.
Clown.
Scarecrow.
Angel.
Doll.

7-, 8-, AND 9-YEAR-OLDS

Any suitable selections from nursery rhymes.

9, 10-, AND 11-YEAR-OLDS

Suitable selections from fairy tales, legends and fables, Baron Munchausen's travels.

STORIES FROM THE BIBLE

For Younger Children

Joseph Wearing his Coat of Many Colours.

Noah Builds the Ark.
Noah Sends the Dove out of the Ark.
Noah Sees the Rainbow.
Mary and the Angel Gabriel.
Mary with the Infant Jesus.
The Nativity.
The Shepherds Amazed.
The Visit of the Kings.

For Older Children

The Shipwreck of St. Paul.
"O all ye little hills, praise ye the Lord."
"The valleys stand so thick with corn that they do laugh and sing."
The Finding of Moses.
Jacob's Dream.
David and Goliath.
King Solomon in His Glory.
Elijah in the Fiery Chariot.
"Glory be to God on High."

SELECTED LINES AND PASSAGES FROM THE FOLLOWING *Narrative Poems:*

The Lady of Shalott (Tennyson).
The Ancient Mariner (Coleridge).
The Pied Piper (Browning).
Sir Patrick Spens (Old Ballad).
"Old Meg, she was a Gipsy" (Keats).
The Wraggle-taggle Gipsies—O! (Old Folk-song).
The Carrion Crow (Old Folk-song).

FROM *A Child's Garden of Verses* (Stevenson):

Rain.
From a Railway Carriage.
At the Seaside.
Foreign Lands.
My Shadow.
Marching Song.
The Moon.

STORIES FROM CLASSICAL MYTHOLOGY

For Younger Children

Persephone Comes with the Spring.
Orpheus and the Wild Animals.
Pluto, King of the Underworld, and his Dog, Cerberus.

For Older Children

Perseus Rescues Andromeda.
Odysseus Watches Nausicaa Playing Ball.
The Return of Odysseus.
Daphne Becomes a Tree on the River-bank.
Jason Sows the Dragon's Teeth.

SCENES FROM *The Lives of the Saints*

St. Francis Preaching to the Birds.
St. Francis and the Wolf of Gubbio
St. Thomas à Becket and the Four Knights.
St. George and the Dragon.
St. Nicholas, the Patron Saint of Children.
St. Christopher and the Christ Child.
St. Jerome and the Lion.
St. Hugh of Lincoln and his Swan.
The Angel appears to Caedmon.
St. Dunstan as a Boy Dreams of his Abbey.
"Thou gentle Michael of the white steed."
The last four stories are to be found in the Scripture Section.

CHAPTER SIX

CRAFTSMANSHIP

BETWEEN the painter's craft and that of the engraver or printer there lies an essential difference. In painting, a child of five or less, possessing almost no technical knowledge beyond knowing which end of his brush to use, can express himself very coherently and completely. The engraver, on the other hand, whether he is using linoleum, boxwood, or steel, must learn to control his medium, and know its possibilities and limitations, before he can begin to tell us what he feels about the world around him. Most children do not need to be taught *how* to paint, for so long as they are given suitable materials and are occasionally reminded of a few of the elementary rules in connection with their use, they will paint and draw as naturally as they sing, dance, or make up stories.

Problems of craft should be dealt with as they arise, while the child is painting. Often we shall be able to anticipate his difficulty and give him the necessary help; occasionally he will appeal to us himself. Technique in the sense of "Mechanical skill in art" (O.E.D.) should not be taught to Juniors. The *rules* of perspective, elaborate colour theories, or a few slick tricks of water-colour technique are of no use to the child; they only confuse him and sap his confidence in his own powers of execution. In any case, much that we tell him will be forgotten unless it is firmly linked to some practical problem of his own.

In Chapter II some suggestions have been made for introducing children to a new range of materials; these are often necessary when children new to the methods or materials arrive in the class. Both time and materials will be saved if the few rules summarized at the end of the chapter are used. We shall often need to emphasize them for individual children. Again, when materials are in short supply and the children are obliged to work with makeshift or unsuitable ones, we must help them to make the best use of whatever they may have. For instance, if only very small paper is available, we can either use sheets of good newspaper painted thickly over with whitewash or Ceilingite, or any pale colour, to remove the print: or we can teach the children to increase the scale of their work by painting one large object—figure, flower, bird, or animal—which will fill up the available space. In this way they will learn to design in a bold way on the small-size paper at their disposal. This dodge may be used, too, when there is insufficient desk or floor space for large paper to be used.

The Teacher a Practising Painter

When we see a child struggling with materials which he has not learned to control and floundering helplessly about in the mess that he has made, then we

SKIPPING (Girl 11 years) Size 23 in. × 15

PLATE X

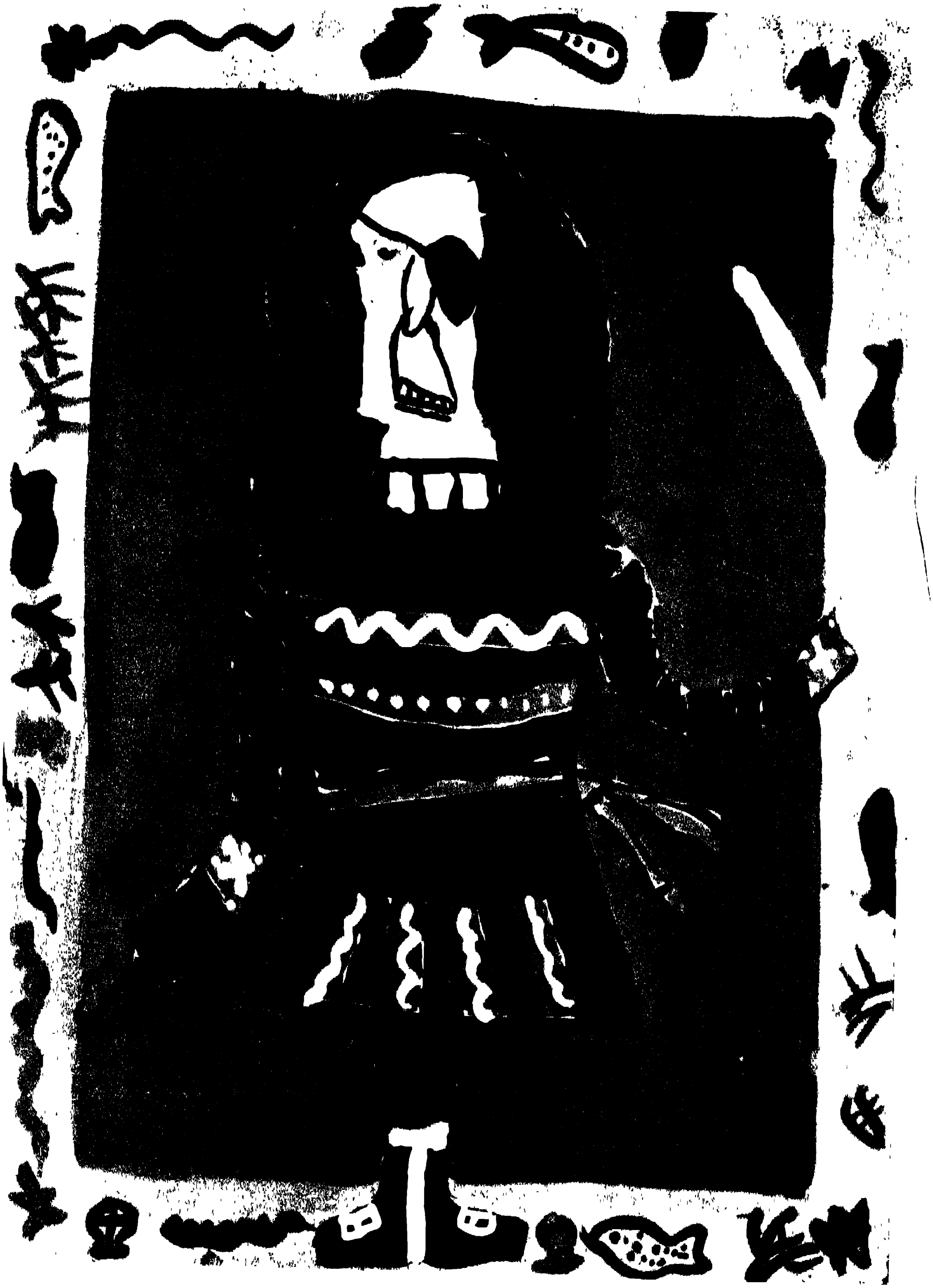
THINGS THAT PROWL BY NIGHT (Boy 10 years) Size 30 in. × 20 in.

PLATE XI

CHRIST WALKING ON THE WATER (Girl 10 years) Size 20 in. × $14\frac{3}{4}$ in.

The drama of the subject has been expressed as much by the emotional quality of the colour and the free handling of paint as by the movement of the figures.

PLATE XII



CAPTAIN HOOK (Girl 8 years) Size 24½ in. × 21½ in.

This picture was painted after the child had seen *Peter Pan* for the first time.

ought to show him how to manage his paints and his brush and to give him as much practical help as he needs to express himself appropriately. Unless we are to some extent practitioners ourselves, we shall not be able to do this. We shall not know why the child is getting into a muddle nor how to get him out of it. This does not mean that we must all become fully trained artists, but it does mean that we ought ourselves to be able to do the various exercises that we expect our school children to do. For instance, we should be able to draw well enough on the board to demonstrate good letter-forms or patterns. We ourselves should be capable of painting the kind of picture that we expect from the children: in order to do this we must spend some of our leisure-time in painting or allied crafts. As painters, we may choose to do figure-drawing, compositions, landscapes, portraits, or flower-pieces; we may prefer to decorate our own furniture, print our own curtain fabrics, or embroider our own clothes. At first this may seem a fearful plunge into the unknown. It may be years since any creative work of this kind has been done, but after a short time we shall find that the duty has become a delight, an added interest in our lives, and we shall have added to our stature as persons as well as increasing our efficiency as teachers. One evening a week at an Art School, drawing or modelling from life, or learning lettering, wood-engraving, or any other craft, will stimulate our interest in many other branches of art. The value of the work we do will lie not in the results of our labours but in our awakening interest in the visual world around us and the deep satisfaction that all creative work brings with it, however simple it may be. As we begin to look about us with the artist's eye, we may also begin to understand his function in society and to appreciate some of the problems of his craft.

Whether we go to an Art School or paint in oils or water-colours at the week-end, two very important points should be considered. The first is that *no attempt should be made on our part to impose the advanced academic training of an art school upon the children we are teaching*; this would be most dangerous and harmful to them. The second point is that, however much we may prefer to paint in oils ourselves (and though the initial expense is greater, this is really a far easier medium than water-colour, which is so difficult that only a few professional painters are really successful), we must also be prepared to paint with the *same materials* that are supplied to the children we are teaching. For it is only by actually handling their materials ourselves that we shall find out their difficulties. We may use a first-class paintbox and good-quality brushes ourselves, but we shall teach with far more sympathetic understanding if we do a little painting on indifferent paper, using the children's paints, and cheap brushes which have kept neither bristles nor shape. Sugar paper cockles if it is allowed to get too wet, and it is almost impossible to make alterations on it without ruining the surface. Again, we shall find that the powder paint which is now generally used in schools is coarsely ground and requires a little skill and patience to mix successfully. It will be necessary to paint boldly and directly, which for us may require a special mental effort. In spite of its difficulties, this medium is

particularly suitable for children who, if they have not lost their natural courage, will work rapidly and with an enviable sureness. The use of powder paint will force us to visualize more clearly so that we too may paint with courage and directness instead of feeling our way through a variety of alterations. By having to make this mental effort for ourselves we shall be better equipped to help those children who find difficulty in expressing their ideas.

Painting a Background

In each succeeding lesson, different points of craftsmanship will arise that may be generally discussed for the benefit of the whole class. For instance, a child may have a large area in his picture which he wants to paint all over the same colour. It may be the walls of a room, on which he will afterwards paint a pattern, or the grass of an aerodrome —the background for his aeroplanes. In each case we shall tell him to mix a large quantity of the colour he has chosen (it is better to overestimate the amount). In this way he will be able to concentrate entirely on the painting instead of having to stop and remix his colour, which is often difficult to match a second time. While he stops to do this, the first part of his painting will have dried and will leave a water-mark where it is joined to the new colour. Again, he may realize that the paint is not going to last out and begin to add water to it, making it weaker in strength and more uneven, as he goes along.

If the child is right-handed, he should begin to fill in a large space at the top left-hand corner and work across to the right (if left-handed, he should begin at the right and work the other way). In this way he will be moving away from the wet paint as he works and will be less likely to smudge his picture with his own hand. He should use the brush in one direction, lifting it each time, not sweeping it to or fro, for painting (we may say to him) is a special activity, unlike scrubbing, or dabbing—painting is only like itself. We shall tell him to keep the paint moving until the whole surface is covered, i.e. to finish one patch off, right to the bottom of the picture, before starting another. We may tell the children that it is always a mistake to retouch wet patches of paint. We cannot make the grass appear greener by painting it over again while it is wet; all we can do is to leave it alone and see what it will look like when it is dry. Paint does not respond to being dragged about; it soon looks lifeless and dull. We must concentrate on covering all the unpainted areas; painting over a large area is a job of work that must be carried through swiftly without interruption. A good many children try to paint a large area by beginning in the middle with sweeping brush strokes in either direction; finally, one side has to be abandoned, and the paint here may trickle uncontrolled down the page or dry leaving an ugly water-mark. From our own experience in painting flat washes, we know that in order to control the paint, we must move the brush from left to right across the page, then begin on the left again and move across to the right; but it would be most unwise to bother children in the Junior School with "correct" methods of this sort. It is quite unnecessary for them to know how to do flat washes, in any case, and advanced technique which

does not apply to their own work will seriously affect their freedom of style.

Many children instinctively put their paint on well; they will not need to be told how to do it. Both to them and to the less gifted we may say: "All good artists enjoy putting their paint on beautifully; their actual brush strokes often tell us something about the objects that they are painting. They will paint the sea in a cold, watery way and the rocks in a hard, jagged way. The texture and quality of the paint will tell us how deep the sea is and how cruel the rocks. Some artists, such as Jan van Eyck, paint thinly and smoothly, working with fine, soft brushes; others paint thickly, using large brushes or even palette knives, like Vincent van Gogh, who actually squeezed the paint straight out of the tubes on to his canvas. We none of us paint in the same way because we are all different persons, and therefore feel differently about many things. Each one of us must find his own way of painting, and we shall do this best if we think to ourselves not 'how ought this to look?' but rather 'how does this *feel*?' If we *think* about people, we shall paint real people, not just dummies with faces of pink icing. Thinking of trees, we shall make tree-like strokes—there is no *way* to paint trees, there is only what we ourselves feel and know about them."

Drawing as a Means of Picture-making

Pictures need not always be painted. On some occasions drawing may be practised for its own sake; some drawings are complete and satisfactory in themselves. Children who draw easily and enjoy it will sometimes tackle most complicated subjects, such as "A fight between Indians and Cowboys," in which there are many figures and horses, or a modern battle scene with soldiers, tanks, and guns. Small boys are especially fond of drawing "battle pieces." They may spend several lessons happily pouring out their knowledge of such things as cowboy equipment or the mechanical details of armoured cars, battleships, and bombers. When the picture is finished, all these things will have been meticulously drawn and presented with the dramatic simplicity of the Bayeux tapestry. Suddenly the idea of painting his picture will occur to the child. Up till now he has been so absorbed with the drawing that he has not thought of it in terms of a painting at all, though probably the images in his head have been coloured. Let us see what will happen. With a brush, which may or may not be the right size, he will begin by painting the choice colourful details first—it may be the redskin's feathers or the battleship's signal flags. When these have been completed, the child will start to struggle with a background which has become intricate enough to baffle all but the professional artist. Soon the delightful drawing is spoiled, paint is trickling down the page here and there and is obliterating many of the careful details. A very disappointed little boy sees his splendid battle picture in ruins. If this happens to him several times, he will naturally be convinced that painting (as distinct from drawing) is something that he can never do. As teachers, we know that this is not true—the remedy lies with us. How shall we prevent a disaster which may be the cause of a very real setback in the child's development? We must be

clear in our own mind as to the artist's attitude towards a painting and towards a colour-wash drawing. A painting is not merely a drawing in which the forms are filled in with colour. It is conceived in terms of colour. Paintings are thought of in terms of one particular medium—the medium which most suitably expresses the artist's vision. Thus some landscapes may translate themselves in the artist's mind into water-colour paintings, others to oil, and others again to pen-and-ink drawings with a monochrome or colour wash. But a boy of 8 or 9 who wishes to fill his pictures with such details as gun turrets or cowboy saddles will be able to express himself far better by means of a line drawing in pencil or pen and ink, than in a painting. Drawings of this kind may be treated in several ways:

Colouring a Drawing

(1) When the drawing is finished, it may be tinted with transparent water-colour to which white pigment has *not* been added. The background may be left white or delicately outlined along the edges, as in a map. For example, a line of hills or mountains may be outlined a pale blue, violet, or green, instead of being painted solidly. The figures, too, may be outlined in colour instead of being painted all over, if the child prefers this. If the colour is to be used transparently, it is a pity to let the child black in some of the details with his pencil. He may scribble all over his horses when he is drawing them; afterwards, when he wishes to turn some of them into bays and chestnuts, his transparent colour will be spoilt by the black pencil scribble showing through it. Most children love to paint tiny details as well as large, bold paintings, but they will neither be successful nor enjoy themselves unless they are given small enough brushes. It is worth keeping a few fine sable brushes about size 5 or 6 especially for such work as this; the use of them should be considered a special privilege, and they should be treated with respect. A child will take enormous pains with his work if he is given a special brush which he can see is the right one for the job.

(2) These drawings may also be executed directly with a pen in waterproof indian ink. Here it is important to note that ink must be used straight away in the first instance. A pencil drawing that has been inked over is quite valueless. The delicate quality of the pencil is lost together with the liveliness of the drawing; the ink line on top will have the careful deadness of a tracing, the vitality of the original drawing will be gone for ever. We shall soon notice the two or three children in a class to whom detailed drawing is in itself a pleasure, and we may suggest to these that they should draw directly in pen and ink. We must see that the pens they are to use are clean and unclogged by stale ink, otherwise the easy flow of the ink will be prevented and the new medium will seem to be difficult from the beginning. We may say to the child "Here is a pen and some special ink for you to draw with. You will like this because your drawing will show up better. You will find that the pen will make all sorts of different kinds of lines for you." With this kind of introduction the child should accept the new medium calmly and draw with it as easily as he has been doing in pencil. Soon he will

be delighting in his swift, lithe line and will appreciate unconsciously the finality with which he must make each statement, for, since alterations cannot be made, each image must be clearly visualized first and put down unfalteringly.

These drawings, too, may be tinted with transparent colour as described above, or they may be drawn on coloured paper (pale blue, green, yellow, or pink) on which the ink will show up well.

(3) Coloured inks are always fairly expensive, but if they are available they should be used from time to time as a special treat. The picture can be drawn in black or coloured inks and the inks themselves painted on with a brush; they may be applied, too, in thin washes on top of water-colour. An exciting range of colours may be discovered in this way. As the brilliant blues and greens are inclined to be crude and unnatural colours, sometimes it will be wiser to use them for purely imaginative subjects, such as "Under the Sea" or "Titania's Bower," rather than for such a realistic subject as "At the Farm." If the drawing is done in black ink and the coloured inks are used instead of paint, a very brilliant effect like stained glass is produced. Children who enjoy drawing small descriptive pictures or painting the jewelled pattern of the butterfly's wing will be delighted with the possibilities of this medium, with its precision and rich contrasting colour. It has its disadvantages, however; like an exotic flavour, a little goes a long way. The temptation to use it indiscriminately is great and should be avoided. Coloured inks should be kept separately from other painting materials and only used occasionally for special purposes. For example, they cannot be used with ordinary opaque powder colour, the crude, almost vulgar brilliance of the coloured ink will destroy the subtleties of the other paint and upset the balance of the tone values. Children who have become enthralled by the emerald-green ink tend to use it on every occasion, with disastrous results and waste of material.

Drawing and painting should be thought of as one process, a part of picture-making. Usually, the practice of drawing first and then painting should be discouraged. Children who intend to paint should add colour to their pictures as soon as they feel inclined to, whether the drawing is finished or not, or better still, start straight away with a brush, drawing and painting at the same time. Those who ask "Please may I paint now?" have been badly brought up. While it is true that a drawing can be an end in itself, a certain charm and clarity is often given to it by the addition of transparent water-colour which shows up the drawing to advantage and does not obliterate any of it. In this instance the drawing may be done first and the colour added afterwards. Opaque colour, such as poster paint, powder paint, or gouache, which has body colour, i.e. white, in it, should not be used to colour a drawing; it often obliterates parts of the drawing altogether. Many fine examples of these pen-and-wash drawings may be found among the works of the eighteenth-century artist Rowlandson and his followers. The same principle applies to numerous sporting prints of the time, many of which were hand-coloured after being engraved and printed. Again, in the botanical books of

the early nineteenth century exquisitely tinted drawings of plants and flowers may be found. In our enthusiasm for the new methods of art teaching we may sometimes forget to make use of the past, and in this case of a peculiarly English tradition. Here is one occasion, then, when rule 3, Chapter II, is laid aside and water, not white, is added to the colour, which must be used transparently.

Clarifying a Picture

As teachers we should be able to help the child to make his pictures clear, that is, to paint each part in such a way that it shows up against the rest so that it is possible to " read " the picture as a whole. This process may be said to be the opposite to that of camouflage. For example, when an aerodrome is camouflaged, devices are used which alter the appearance of the buildings and break up their shadows; in this way they become indistinguishable from the surrounding countryside. The artist, on the other hand, is concerned with arranging colours and shapes one against the other so that each may be clearly seen in a particular relationship to the next. Children often find white paint irresistible; they are inclined to draw or paint with white on white paper. We can say to them that, just as black chalk would not show on a blackboard, so white paint will not show up on a white background; it is like a piece of camouflage. Similarly, they may paint a figure in a yellow dress with golden hair against the yellow-gold of the seashore, or in a green dress against grass or trees of the same green. None of these figures will " tell," for as soon as the picture is held up at a distance (and this should often be done for the child to see his picture as a whole) the figure will disappear into the background, while details such as hair ribbons or belts which have been painted in complementary or contrasting colours will " jump " off the paper and distort the picture. If white cartridge paper is being used, it is usually best to leave the paper unpainted where white is required, i.e. clouds, swans, whitewashed houses, sheets, etc. White paint will not look so bright as white paper. If the paper is toned, then white will show up well, but it must be painted thickly, otherwise the colour of the paper will show through. (See Plate XX.)

By using strong contrasts of light and dark colours, the children will learn that the effects of colour are relative. For example, we may remind them that it is only when the sky begins to get dark that we can see the light of the stars; they do not show at all in the bright sky of day; if stars and moon are to shine in a picture, they must be painted in a dark sky. This principle can be demonstrated by writing out a notice on a large sheet of white paper, using a different colour for each line. The children will find it very difficult to read the lines that are written in white or yellow, but those written in red, dark blue, or black will show up well. The same colours may be used on black paper with the opposite result. The white and the yellow will shine brilliantly, while the black will disappear almost completely (Plate XVIII).

When snow is on the ground and the sky is overcast, we may ask the older children to tell us which is the lighter colour, the snow or the sky. They will see that in these conditions the sky may be darker; sometimes when more snow

is on the way, it is a heavy fawn-grey. The trunks of the trees and the sides of houses and fences will look very black, and these in turn will make the snow look even whiter. This will be an opportunity to break away from the worst of the popular Christmas-card tradition with its bad design and cheap idea, for the children will see for themselves that snow lies on the top of the branches and bushes and, unless it has been blown by the wind into drifts, it lies on the tops of chimneys, gate-posts and post-boxes, on roofs and window ledges, but does not entirely envelop these. We shall tell the children that the snow in the pictures will look whiter if their trees and the sides of the houses are painted a dark colour. A picture that will illustrate these points well, and one which the children will enjoy looking at, is the "Hunters in the Snow," by Pieter Brueghel. There are many other Flemish and Dutch pictures of winter scenes which are suitable for children; from these they will see how well brightly coloured figures look against the white background of the snow or on the ice.

It is only by understanding and foreseeing the kind of difficulty which the child is likely to encounter that we shall be able to prevent him from getting into a hopeless and discouraging muddle. We shall see that he learns to control adequately whatever materials he may be using. In this way he will be able to express himself more fully and will not feel continually frustrated by unsatisfactory results. In teaching technique of this kind, however, we shall remind ourselves that ultimately it is what the child has to "say," rather than the way in which he has learned to "say" it, that is of value. This will prevent us from giving him technical advice beyond his need or for which he is not ready.

Correcting Mistakes

Inevitably some pictures will go wrong; paint will run; poor-quality paper cockles easily or tears, and accidents of various kinds occur. It is important that we should be able to help the child to repair the damage whenever possible. When the accident is unimportant and only involves a small piece of the picture, it can be rectified in various ways:

(1) By removing the paint that has run or gone over the edge, with an almost dry brush or blotting-paper, and repainting later when the surface is dry.

(2) If the paint is well "set" from the lesson before, an alteration may be made by moistening the place with clean water and later mopping the softened paint off and blotting as before. A more direct and less troublesome way of making this kind of alteration is to paint thickly with white over the area which is to be altered; painting on the top of this when it is dry. The white must be put on rapidly with very little water, so that whatever may be underneath remains undisturbed. While it must be put on thickly enough to be opaque, if put on too thickly it may crack and flake off.

(3) Sometimes the accident can be turned to good account by adapting the smudge. Its peculiar shape may easily suggest another figure, a bush, or part of a house, for instance. In this connection we may tell the children that the artist does not always know exactly how his picture will turn out. Sometimes he will achieve effects apparently

by accident, but his specially trained sensibilities will tell him when to make good use of the accident and when to scrap it.

(4) The simplest way of dealing with a painting that appears to have been ruined beyond repair (one on which paint-water has been upset, for example) is to hold the whole picture under running water and wash all the paint off. Sometimes it is necessary to sponge the picture lightly in order to remove the paint evenly. The wet paper must now be pinned on to a board and allowed to dry; the original painting will show faintly, and when the paper is dry the child may begin to work on it again. Paper of a poor quality will not stand much sponging or rubbing and must be treated gently when it is wet (children should be discouraged from using rubbers on wet paper at any time), but good-quality paper may even be scrubbed without taking any harm.

Rulers and Compasses

It is sometimes thought that it is unwise to allow children to use rulers or compasses in the art class. A ruler is useful for measuring a border round a picture, though a piece of paper with a mark on it to show the width of the border is equally good for this purpose. When a child uses a ruler for drawing a castle, a house, or the corner of a room, it is often a sign that he is not sure of himself, he feels that his drawing will be "correct" or "nice and tidy" if he uses a ruler. But the ruled line is impersonal and lifeless, the child's ideas cannot be conveyed by such mechanical means. *It is by his own "handwriting," which is his personal means of expression, that he tells us what is in his mind.* Besides this, the use of a ruler will not help him to execute his picture rapidly; he will take longer than the other children who are drawing freely. To the child we may say: "Never mind if your lines are not straight—this is not at all important. Hurry up and paint your castle, so that we can see what it is like before the lesson is over." At this point it will be wise to thrust a brush ready filled with some attractive colour into his hand and say: "Here you are! Paint straight off with this; you will find it so much easier and quicker." We may not be able to wean him from his ruler at the first attempt; it is not simply a question of telling him not to use it, but of teaching him a new set of values. If he draws shakily and seems dissatisfied with his own efforts, we can help him a little by telling him to draw the required line rapidly, moving his arm from the shoulder rather than the wrist, while keeping his eye fixed on the point he wants to reach. The practice of writing patterns will help to give him confidence and the necessary muscular control.

The usefulness of compasses in the art class is equally limited. If it is used for making geometric patterns, it is positively harmful. Pattern-making cannot be a creative adventure when the means of construction are almost automatic and impersonal. Making patterns with compasses in this way provides an excellent diversion for the child who is ill in bed and cannot be expected to make much effort; he will be able to amuse himself by filling in the spaces with coloured chalks (an activity which is too often found in schools), but this is indeed tame and uninspiring work for healthy, vigorous children who can mix their own paint

and apply it with the sure instinct of the artist.

An Introduction to Perspective

We have already said that it is only necessary to teach the most elementary perspective to children under eleven. There are children with a special ability for drawing, to whom perspective will never present any difficulty. They have a more advanced understanding of the structure of the things they draw—figures, houses, buses, streets, ships, etc. —than other children of the same age. We shall be careful not to bother these children with rules of perspective which they do not need; instead, we shall help to develop their powers of observation through the understanding and watchful eye of the artist, as distinct from the accurate recording eye of the scientist. When we speak of the artist's eye we mean not merely the recording eye which stores up factual information for the mind to use, but the eye which notes those relationships of form and colour which have some personal meaning for the artist and which he wishes to paint. In the past, art teaching has emphasized drawing primarily as a means of representing observed facts. Its recognition as a necessary part of the school curriculum was often due to its usefulness as an adjunct to other subjects (especially natural history, history, and geography); this attitude almost entirely ignored self-expression. In recent times the Ministry of Education have lent the weight of their authority to the new methods. In the 1938 edition of the *Handbook of Suggestions for the Consideration of Teachers,* we read: "The spontaneity, the freshness and vigour which are characteristic of the free expression of young children's drawings and paintings should be recognized as of greater importance than an imitative accuracy, but it should equally be recognized that for the normal child it is as natural to make progress towards adult standards in the language of drawing as in the written word."

Just as it is unwise to teach rules of technique to a child who does not need them, it is equally foolish to withhold information from a child whose progress will be hampered without it (Plate XIII). There will be children among the 10- and 11-year-olds who are worried because their work does not "look right." The graphic symbols that have satisfied them in the past no longer do so. We may take these children to one end of the classroom, or to look out of the window, and point out to them that all objects appear to diminish as they go farther away. A child will be able to see the truth of this for himself and there are many simple ways in which we can demonstrate it further. To the older child who has drawn a table more or less in plan but with its legs splayed out sideways, instead of vertical, we shall say: "You know, as long as we stand upright on our feet, things like the legs of tables, chairs, and beds, the sides of houses and doors, always look upright too—that is, straight up and down like the side edges of your paper. Of course, if we fall over, we get quite another view of the world. We saw just now," we may continue, "that the room looked smaller at the far end; in the same way we shall find that the far edge of the top of the table looks a little smaller than the near edge; if you think of it in this way, you will find that the table is easy to draw.

Tell me which side of your table (or bed) is nearer to you as you look at your picture?" When the child has pointed to the near edge, we may say, "Then this edge will look a little longer than the far edge of the table." Again, we may explain in the same way that the first sleeper on the rapidly vanishing railway line will be much longer than the last one at the other end, which may appear to be a mere dot if the vista is long enough. We shall tell the children to look out for this when they are near a railway. Standing on the bridge, they will see the sleepers get smaller and the rails appear to meet in the distance; they will see the trains grow larger or smaller as they come and go; looking down the long, straight road they will notice the same apparent distortions.

A Change of Medium

When we find that a child's work appears to be less good than usual, we shall consider whether a change of medium or of occupation may not be what he needs. Pen-and-ink drawing, modelling, paper-cutting, or collage may be substituted for tempera painting for a time, or we may invite the child to help us with some simple practical job, washing-up, repainting paint-tins, tidying cupboards, arranging flowers, or helping to mount pictures. We may be able to give him a little extra attention and interest him in the craft of painting by teaching him the names of the colours as they are known to the artist; for example, Burnt Sienna, Raw Umber, Yellow Ochre, Venetian Red, Ultramarine, or Viridian.

We shall recognize that just as there are many different kinds of personality, so there are correspondingly different ways in which children will express themselves. With some, the nature of their personality as artists remains "primitive" and does not develop beyond this stage, though it may reach a high pitch of perfection within it. In view of this, it will be seen that as teachers we must exercise the tactful understanding which will not attempt to force a child in directions which are alien to his nature.

CHAPTER SEVEN

DRAWING THE FIGURE

CHILDREN who have lost confidence in their power to express themselves will show this in a variety of ways, but perhaps the most noticeable trait will be the persistence with which they avoid drawing figures. Sometimes children who are most able in other directions will announce blandly or apologetically that they are quite unable to draw figures. "I never have been able to" is a favourite expression, implying that further attempts are doomed to failure. So certain are they that the ability to draw figures is some sort of inborn gift, like having "perfect pitch" (and in this they are aided and abetted by ignorant adults), that they assume that nothing can be done for them, that their case is hopeless. The children who have been told they have no gift for drawing are only one degree worse off and more deluded. Although there are, obviously, varying degrees of talent, all young children can draw amazingly well, and, unless their confidence in themselves has been badly shaken, they can also draw figures as well as anything else.

Development of the Figure

Children who have begun drawing figures, houses, ships, buses, etc., from the age of 3 or 4, will have the natural confidence which is every child's birthright. They will start by drawing simple, rounded forms with arms and legs sprouting from the sides (Folder, top picture, "Here we Come to the Harvest Festival"). These will develop into longer stick-like figures, to be followed in time by larger upright figures with solid arms and legs and heads more in proportion to the whole. These figures will begin to look less like formal symbols and more like real people. As the child goes up through the Junior School, he will make their faces express such simple emotions as happiness, grief, or anger, and, by bending their arms and legs, such actions as running, sitting, or kneeling will be expressed. Finally, between the ages of 9 and 12 the child will begin to visualize groups of two or three people, and where previously he dotted his figures about his picture, thinking of them singly or as part of a two-dimensional pattern, he will now begin to think of them three-dimensionally, that is in the round.

From time to time nearly every teacher finds children who are unwilling to try any figure drawing. A good way of overcoming the lack of confidence which is at the root of this difficulty is to give the whole class an imaginary portrait to paint. Let us suppose we are giving the lesson to a class of children about eight years old: this is the time when they might normally begin an exercise such as this, but the basic principles of the lesson may be introduced, with suitable subjects, at any age from eight years onwards. It should be quite unnecessary to give a

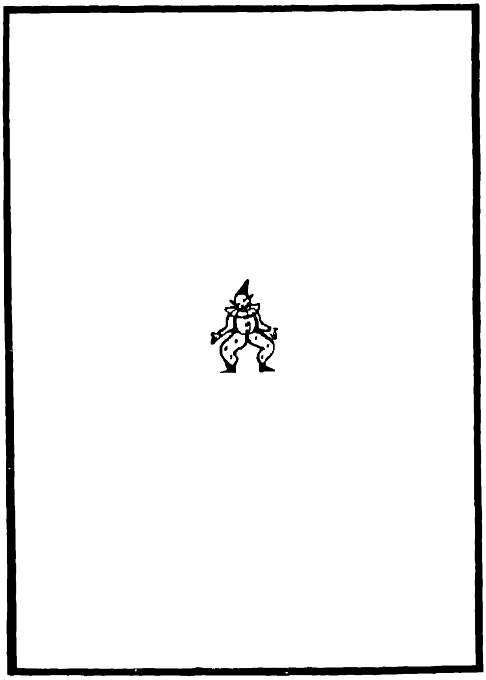


Fig. 24.

planned lesson of this kind to children below seven. Before beginning the lesson, it will be necessary to have thought out one or two suitable subjects which may be written on the board. Several of these will be found in Chapter V, and there is a further list of subjects at the end of that chapter.

Beginning a Portrait—First Lesson

When each child has his piece of paper and is ready to begin, he may be told to turn it up the longest way because a figure will fit in best this way. Then we may begin the lesson as follows: "Today we are going to paint portraits. A portrait is a picture of a person. Important people like the Lord Mayor have their portraits painted so that we shall know what each Lord Mayor looks like. A portrait can be a picture of a whole person from top to toe, or it can be just a head-and-shoulders, or 'half-length,' which is down to the waist, or, 'three-quarters' length, which is down to the knees. Whichever kind of portrait you choose to do, it must tell us a great deal about the person." Let us suppose that the two subjects which have been written on the board are a Funny Clown and a Lady in a New Hat. The lady will appeal to girls of course; some boys will also like the idea of painting flowers and furbelows, though most of them will probably choose the clown. The title Funny Clown has a special purpose, it may be used to give confidence to those who need it, as is shown in Chapter IX. For if they paint a clown, it does not matter how "funny" he is, as clowns are supposed to be funny and grotesque. But in this chapter more direct teaching is suggested, because the child needs help in this specific way.

When the children have been invited to choose one or other of these subjects, a short description should follow in this manner: "As you are going to paint a picture of a person, you must draw the person very large indeed. Whether you have chosen to do the clown or the lady, you must fill *all* the paper, otherwise we shan't be able to see what your picture is about. You might draw a very nice clown like this (Fig. 24), but if he is so small, you won't have much fun painting him, and no one will be able to see what your picture is about unless they put spectacles on. Also, you would have to work very hard to fill in all the spaces you have left round about, after you have finished the clown. So we shall all draw our portraits as BIG as the paper will allow. If you have chosen the Lady in a New Hat, you must leave enough room at the top

of your picture for the hat, as you may want to put feathers or wonderful flowers on it later on. The clown may need a hat too—that is for you to decide, but if you want him to have one on, you must leave room for it. In any case, the head must be big, or we shan't be able to see what the person is like, and near the top of your paper, or you won't have enough room left for the body."

If there are paints available, it is much better to let the children " draw " straight away with a brush. This prevents them from making several tentative beginnings with much rubbing-out and consequent waste of time and energy. Drawing directly with the brush should always be encouraged, especially when large work is being done. The child is prevented from dashing down the first thing that comes into his head; he has to be more deliberate if he knows that he can only depend upon himself and not on alterations made possible by rubbing-out, also that he will have to visualize his subject more clearly before he begins. He will discover, too, that far more pleasure is to be found in painting directly on the paper without first drawing, and he will gain an enormous amount of confidence when he finds that he can do this quite easily.

Just before the children start, it will be wise to emphasize yet again the importance of making the figure fill the space; sometimes the children will compromise by drawing a narrow or short figure which is big enough to be seen but is not big enough to dominate the whole picture. In this way large spaces are left on each side of the figure; and these prove to be very difficult to fill successfully.

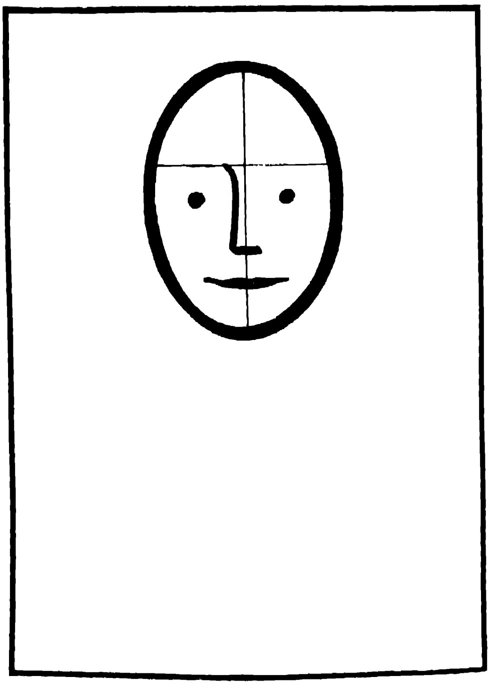


Fig 25.

Besides teaching the child how to overcome his fear of figure drawing, this lesson is an exercise in composition; in learning to design the figure within a given space. Most of the children will be able to start straight away without difficulty, but there may be a few who will find it hard to take the initial plunge. We shall have to go round the room to make sure that these are really drawing the head large enough. Sometimes we shall have to stand beside a child and make him start by saying, " Come on now—a head is only like a big Rugby football; just draw a big ball for me—it's really very easy! " If there are many children who cannot begin, it may be necessary for us to draw a large head on the board, instead of going round individually, which is the best way if the size of the class will allow it

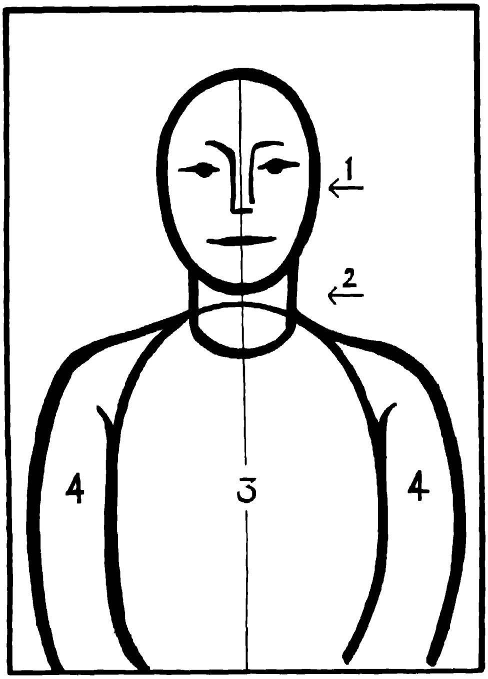


Fig 26.

(Fig. 25). If some have already drawn the head too small, they must either turn over on to the other side of the paper right away (this time we may help them by putting two little marks on their paper to show where the top and bottom of the head ought to be), or they must draw again larger on top of their first effort; if they paint thickly enough, this can be covered over and need not show at all. Children always like to have a clean page to start with, however, and they may be less put out by turning the paper upside-down and beginning on the unused end. Speed is a factor in overcoming fear in their case, the more quickly every child can be made to draw a large football and turn it into a face the better.

Now we shall ask the children to draw the neck, arms, and body; these we shall assure them are also very easy. The neck is only like a drainpipe; previously they may have left it out altogether. They may feel the thickness of their own necks before they begin to draw, and put their hands on their shoulders to feel how these jut out each side of the neck. Here we may demonstrate that the arms are attached to the shoulders so that they can be moved freely (Fig. 26).

Any drawings the teacher may have done on the board should not be left there for the children to copy. They should only be made use of if the children are really unable to begin, and then wiped off almost as soon as they have been drawn.

At this point each child should begin to paint freely all over his picture. We may make the following suggestions to help those who appear unable to continue alone. "When you paint your lady's hat, choose a lovely colour that you would like her to have and draw it straight away with a brush; then you can decide what you think will make the hat look really smart, coloured bows, ribbons, feathers, flowers, or a veil." To the children who are painting the clown we can say, "I hope you are going to make your clown look very funny—he can have any kind of hat you like with feathers or bells or pompons on it. His coat can have big buttons or be decorated with all sorts of different-coloured stars and moons with spots, stripes, or anything else you fancy that will make your clown look jolly."

While most of the children are busy painting the head, coat, or dress of the figure we shall find a few who will need some practical help. As in other lessons, it will be necessary to repeat that fresh

paint must be allowed to dry before anything else is painted on the top of it. For example, if the paint on the coat is still wet, it would be a mistake to paint buttons or a lace collar on the top of it, the paint will all run and the result will inevitably be a very messy picture. As we go round the class we shall find some children who have mixed too little colour at a time; in their excitement they have begun by painting several different parts of their picture at once, then they will find it is difficult to mix the same colours again in order to complete the unfinished patches. We must show them how to mix enough colour to cover a large area at one go. This is important, because if they do not mix enough paint to begin with, they will soon be adding water to it to make it last out, and this will ruin the texture of the picture, because some parts will have been painted in opaque colour while others will be thin and transparent.

It is advisable to try to get almost every child to cover his figure with paint by the end of one lesson. This will give the child a sense of achievement, it will also be a point of departure for the following lesson. Whether this can be done will depend on the art period and the number of children in the class who need individual help. We shall be well advised in any case to urge the children to put the paint on as quickly as possible, as this will help the most timid to acquire a bold, free style and prevent them from fussing over their work and painting in a niggly way.

The Second Lesson

At the beginning of the next lesson, each child's work may be given back to him with suitable comments. In order that these may be to the point and the whole process may take up as little as possible of their valuable painting time, we must look through the work well before the lesson begins; then as we give it back we shall make the kind of suggestion that will help each child to begin painting again. Only experience and our knowledge of the individual children will help us to know which ones need to be told what to do next and which of them know exactly how to proceed, as soon as they see their work again. For some children a whole afternoon devoted to painting will not be too long, and of course they would benefit in many ways if they were allowed the unbroken continuity of effort which a longer period would give them. Unfortunately, many schools now have time-tables in which there is an interval of a week between each short lesson. Though artists would find it extremely difficult to produce pictures by this disjointed method, children, being adaptable creatures, appear to be less affected.

Some will need to add ears, hair, or arms to their figure (children often leave out an essential feature or limb). For instance, if the hair has been left out by a number of children in the class, this might be discussed rather generally, on these lines: "You must give your lady the nicest hair you can think of. Some people admire jet-black hair when it is nicely pinned up, and some like golden curls; hair can be any colour; and it can be long or short, straight or curly, so you must decide this for yourselves. If you are painting the clown, you can give him any kind of hair that will look 'clownish.' Some clowns have their

hair brushed up into three pointed tufts, one on each side of the head and one near the top; some have pale, straight hair sticking out all round under their hats." Usually if we ask a few leading questions, the children will be able to provide a great deal of the kind of detail that is required. This is the best way of collecting such information.

Backgrounds

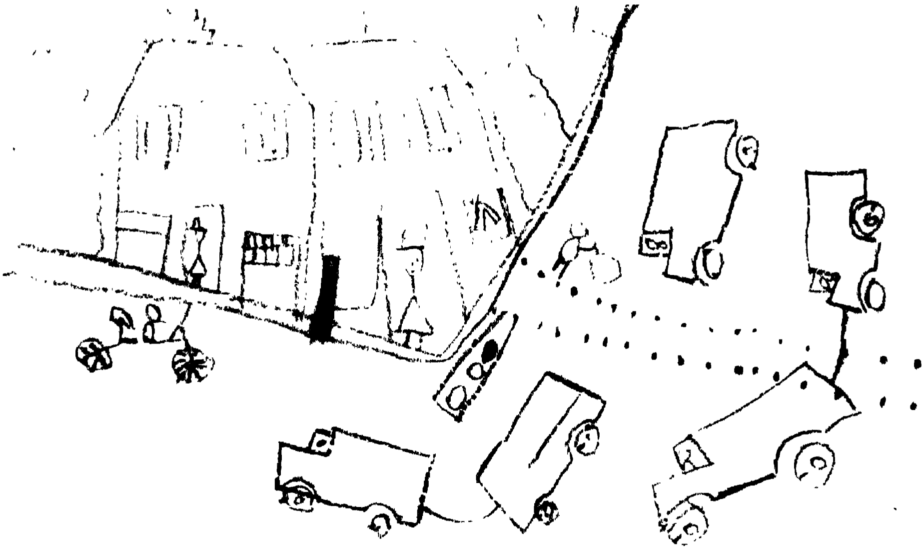
They will enjoy suggesting suitable decorations for coats and hats or ways of making the clown's face look funny, or, with a little help from us, they will be able to consider some of the ways in which the background may be made interesting. This is a problem which will affect all the children, therefore a general statement may be made as follows: "By now your figure is nearly finished, and you must think what you will paint in the spaces that are left. If these are small and most of your picture is filled by the figure, you will only need to choose some colour that you like and paint it in the spaces as a background. Of course you must choose a colour that will look beautiful with the colours that you have already painted. If the spaces are fairly large, you may like to paint a pattern in them. The movement in your pattern can go either up and down or across your picture, or even diagonally if you wish, but you will have to decide this for yourself. Which kind of pattern and colour will look best will depend on the way you have designed your figure. If you look at your own picture and think about this for a moment, you will soon 'feel' what kind of pattern is the best."

It will be found that a pattern which runs horizontally often helps to balance the perpendicular emphasis of the figure, but since we want the children to feel and think for themselves, it would be a mistake to suggest this to them. The younger the child the better his sense of rhythm will be, and it is this normal perception of rhythm relationship which we wish to cultivate and not a blind acceptance of a set of values or suggestions. We may find it necessary to indicate by gestures what is meant by the pattern going diagonally. This is far better than drawing something on the board which the children will certainly copy.

"If there is plenty of room behind your figure, you may like to paint a simple scene as a background. For instance, your lady can be indoors standing by a window with pretty looped-up lace curtains on each side of her or out of doors in the country or in the park with trees and flowers. The clown might be in the circus or on a pier at the seaside. The sea with ships on it would make a very nice background for him."

Figures in Other Media

This lesson may be followed up by the same kind of exercise repeated in a different medium, perhaps paper-cutting or clay-modelling. A change of activity of this kind may be beneficial for a week or two before proceeding further with figure drawing. The children may work in clay or paper, provided that in each case no preliminary drawing is done, that is, the clay should be modelled directly and the paper cut or torn straightway. We may tentatively suggest that they might like to model a head and shoulders in clay or Plasticine, or cut out a figure in paper, then cut out coloured clothes to stick on



(a) (Boy 9½ years) Size 18 in × 11 in.

(b) (Girl 9½ years) Size 15 in. × 11 in.

Perspective should not be taught to either of these children. The boy is not nearly ready for direct instruction. His picture is a two-dimensional pattern, partly conceived in plan. The girl is solving the problem of three-dimensional foreshortening in her own way. She has turned the corner naturally and needs no help until she asks for it.

PLATE XIV

(*a*) MADONNA AND CHILD (Boy 9 years) Size 20 in. × $12\frac{3}{4}$ in.

The monumental quality of this painting may be compared with works by the Sienese painter *Duccio*.

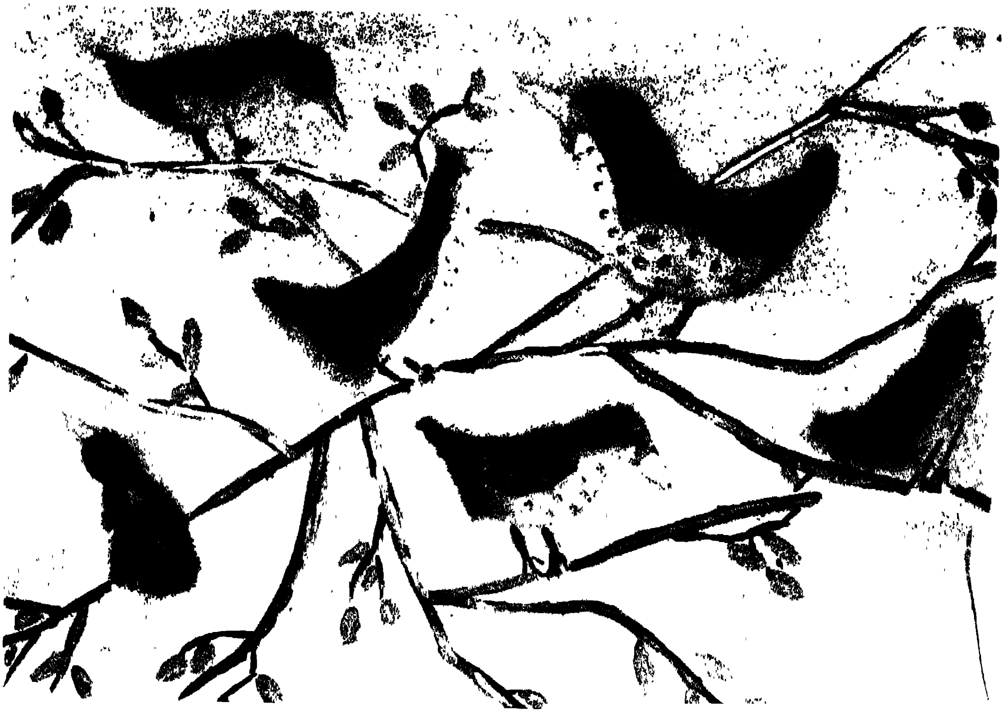
(*b*) CHRIST PREACHING TO THE MULTITUDE
(Girl $10\frac{1}{2}$ years) Size 7 in. × $5\frac{1}{2}$ in.

A frontispiece illustrating writings from the *New Testament* which were written out, decorated and bound together in book-form by the child.

PLATE XV

THE VISION OF ST. EUSTACE by *Pisanello* (National Gallery)

PLATE XVI



(*a*) A TREE FULL OF THRUSHES (Girl 11½ years) Size 21½ in. × 15 in.

(*b*) WILD ANIMALS (Boy 7 years) Size 21½ in. × 15

top of it (see Chapter XI). The clay model should be very simple indeed—a round head like a ball with a hole underneath it into which is inserted the neck, like a piece of pipe; this is in turn inserted into a hole in the top of the body, to which arms may be added. The whole thing may be cut off flat with a knife at the waist-line or below the shoulder, so that it will stand by itself. Hair, feathers, buttons, etc., can now be added according to taste. Children who make figures in either clay or paper are repeating their lessons in figure drawing; though they may realize this when cutting or tearing paper, they will be less likely to when modelling. This unconscious practice is always beneficial, for in this way some difficulties are overcome almost before the child is aware of them.

Now is the time for us to watch what the children are doing and how they have responded to our suggestions. There may be some who will prefer to do patterns instead of working with clay or paper, and this may be an indication that they still regard figure drawing as something beyond them. Even among the children who decide to work with clay or paper, there will be some who still show signs of being afraid to tackle the figure, while others who have obviously benefited by the previous lesson will be making good progress and enjoying the work.

Different Aspects of the Figure

In the lessons that follow we shall endeavour to give extra help and encouragement to those children who have not yet solved the problem of simple figure construction for themselves. When we return again to figure drawing, we may begin by explaining to the children that a portrait may be drawn either full view, three-quarters view, or side view. In order to make this quite clear, we may invite a child to stand in these three positions in relation to the rest of the class. Then the simple football diagram may be drawn on the board full face and side face for children under 10 or 11. The problem of the three-quarter face, which is a far more difficult and adult concept, should be left till the children are older, when it will arise naturally, and they will then want to know more about it. In order to avoid almost all the finished portraits facing the same way, we must draw two side-view diagrams facing in opposite directions (Fig. 27).

A boy and a girl may now be asked to stand in front of the class in profile, facing away from each other, and we shall

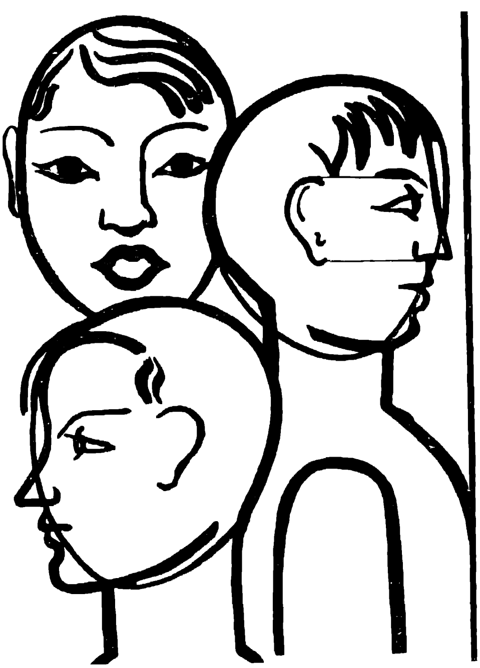


Fig. 27.

say something like this: "We all know our noses stick out from our faces. If you look at Tommy and Mary, you will see that their chins stick out too. We can put a hand under our chin and feel how it sticks out. Although we know they each have two eyes and two arms, now we can only see one eye and one arm. The arm which shows appears to be in the middle of the side view we have of the body between the curving chest in front and the back. We can easily imagine what Tommy and Mary would look like if they were very fat people. Their faces and arms would be larger and more round, their arms would look as if they were going to burst out of their sleeves, and they would both stick out enormously in front. Perhaps you would like to do a picture of a very fat man going to catch a train, or of an old lady going shopping. If you want to tell us what a fat man running for a train looks like, you will have to draw the whole of him, but still you must draw him as big as you can, his head at the top and his feet at the bottom of the paper. So long as you fill the space almost completely with your figure, you can choose whether you will draw the head and shoulders, only half a figure, or a whole figure."

The results of this lesson will show us how far the children are ready to draw the whole figure or only the head and shoulders. With some children we shall have to proceed cautiously, gradually extending the figure and increasing the problem as the child becomes more capable and confident. As soon as he feels more at ease, he will begin to enjoy himself, and if he is not hurried beyond his own natural pace he will become adventurous on his own account. Some children, however, may repeat the same portrait picture two or three times before they feel able to venture on anything fresh. We must be patient with them. If they have had their confidence shaken by bad teaching in the past, they may now be experiencing the pleasure of achievement for the first time. They have gained our praise, and they may repeat the picture in order to win approval again. By maintaining an attitude of approval and showing that we are on their side, we shall help them to take the next step forward *by themselves*. Their security will lie in the knowledge that we are there in the background to help them if they need help, but they must not be allowed to become dependent on us.

When a child can draw a full-size figure which will fill up his picture space, he will have made real progress. Some children's development may be slow and their figure drawing appear to be very primitive at first. We must not be critical of them, though we may give some help with the details from time to time. For instance, if the body has been drawn solidly but the legs and arms are still like sticks—expressed by thin lines—to a child of eight or more we may say: "Can you put your fingers round your leg? You can nearly, can't you? Now tell me—is your leg thick or thin?" He will answer that it is thick. Then we may say, "Well, you must make the fat man's legs thick, too; then you can paint them and tell us what he is wearing. You know if he really had such very thin legs he would soon get tired, wouldn't he? Our bodies are heavy; our legs have to be thick and strong to support them." Again, if older children still go on drawing tiny

little hands, we may say, "Can you cover your face with your hands?" When they find they can do this quite easily, they will laugh at the size of the hands they have drawn. In this way we shall begin to train them to use their own bodies to find out how the human figure works. They will not be merely copying what they see, they will be drawing something they are beginning to understand; absorbing some simple piece of structure first and drawing it afterwards.

Composing with Two Figures

Now the time has come for making pictures with more than one figure. Such subjects as "Mother and Child," "My Friend and I," "Having my Hair Cut," are good. Here again, by making use of two of the children from the class, we may arrange a very simple sort of tableau. If the children are 8 or 9, it will be better for this demonstration not to choose the subject we want them to paint. We may choose some other subject, such as "Look what I have found!" Then two volunteers will be asked to stand in front of the class, where they can be seen, but some yards apart, and we shall say to the rest of the class, "Let's pretend that John has caught a strange moth in his hands. Charlie wants to see it, but he is a long way away. What must he do to see what John has in his hands?" The children will see at once that Charlie must move much nearer. Then he will be asked to walk right up to John and to look and see what treasure it is that he is holding in his hands. The two children may make an interesting group quite naturally, or we may have to help them a little, so as to prevent one child from obscuring the other altogether, and so on. When the little tableau is completed, one aspect may be emphasized as follows: "Now you may choose one of the other subjects and think about it before you begin. Try to see the two figures, perhaps the mother and child, clearly in your head and in close relationship to one another. If you are doing a subject of this kind, you must think of your figures together and draw them together. If they are separate, your picture will not make much sense. For instance, if you were going to button up your little brother's coat, it would be no use your being the other side of the room from him; you would have to go near him to do it." If the children in the class are 10 years old or more, they are approaching the age when children begin to record what they see, and they may benefit from actually seeing two children represent the subject as described above. This will then be an exercise in memory rather than imagination.

Finally, subjects may be set which do not put all the emphasis on the figure alone, but in which there will be people engaged in any of the various occupations of everyday life. Sometimes we shall choose subjects which have movement in them, such as "Stop Thief!" or subjects in which the body must be flexible, as "Climbing Trees," "The Wonderful Acrobat." Very occasionally it may be found that actual drawing from a model can be done in the Junior School among the oldest children, but generally it is far better to leave drawing directly from observation until a much later stage has been reached.

Figure drawing evidently presented no difficulty to the children who com-

bined to paint the frieze "Dancing in the Chequered Shade," depicted on the folder. For here the figures, each characteristic of the child's age, have been painted with an enviable sense of ease and liveliness. Full of self-confidence and unhampered by the fear of making technical mistakes, each child has been free to feel the exhilaration of the dance, and this, together with the children's own pleasure in doing it, has been most satisfactorily expressed.

CHAPTER EIGHT

VISION AND APPRECIATION

IT has been said that the enjoyment of the arts depends more upon the senses and the emotions than on knowledge or intellect. We shall have little doubt that this is true of young children if we watch them at work. Given the right materials, they display a real appetite for painting. It is perhaps difficult for us in this country to appreciate the sensuous quality of children's enjoyment. A little girl of 7 who had been to the National Gallery for the first time described her pleasure in the pictures in this way: "It was lovely! It was like two hundred ice-creams all different colours, all flashing together!" It is interesting, too, to note that "St. George," and "Bacchus and Ariadne," both by Titian, were the pictures that she said she had enjoyed most. In the same way, children from infancy show a sensibility to changes of texture, constantly exploring surfaces of all kinds by stroking and touching. As teachers of children we shall try to foster this natural sense of enjoyment and curiosity; it is from such roots as these, rather than from our intellectual heritage with its stress on the mental as opposed to the emotional, that true appreciation of all great art springs.

If we attempt to force the child's æsthetic appreciation by teaching it "how to draw" before it has been educated in seeing and feeling, we shall succeed only in producing some slick, precocious work in early adolescence at the expense of drying up any genuine talent or sympathetic understanding that there may have been. It will be seen at once that the education of the senses cannot be accomplished in a set lesson or a series of lessons; to be effective, it should be part of the daily background of the child's life over a period of years. Our own attitude towards the children, the kind of atmosphere which we create in the classroom, together with the actual arrangement of this room, will all combine to further the development of the child in this direction. Time, too, is on our side, for it is probably while the children are still in the Junior School that they will be most receptive of impressions perceived through the senses or with the emotions. In our painting lessons we are necessarily concerned with the appearance of things around us. Our personal sensibility in this direction will be felt by the way in which we arrange our own rooms. But the effect on the child will not be immediately obvious—indeed it will largely be absorbed unconsciously, and the development of this æsthetic sense may only be apparent years later when he has passed out of our hands.

Although it is often more convenient to have one room in the school, such as a studio-workshop, set aside for art teaching, it is even better from another point of view to transform our ordinary

classroom, which is being used for all lessons, into a room where there is a special emphasis on art. In this way the children are more likely to feel that art is a part of their lives, something of which they expect to see evidence every day. If they only visit the art room or studio once a week, they will think of art as something separate, divorced from their daily lives, something which appears out of a cupboard on Wednesday afternoons.

We shall hope that the children will feel that our room is different from the other rooms in the school. Here they will find an atmosphere which, while it is stimulating and suggestive of a variety of activities, is also calm and unhurried—a place where the child has breathing space, where the tempo of life is slowed down and he has the leisure and opportunity to explore those things that interest him most. We should be able to provide a place for him where he will not feel continually pressed by time nor the urgency of the examination.

The Choice of Pictures

For our special purpose we shall present those things which particularly have a visual or tactile appeal—pictures and still-life groups which the children will enjoy looking at, natural and man-made objects of different textures and shapes which they will enjoy handling. The pictures we shall choose for Junior children will be those that they can understand and enjoy. It is sometimes thought that "nothing but the very best" is good enough for children; the truth is that they need the very best within the compass of their understanding. The works of the great Italian masters of the Renaissance—Raphael, Michelangelo, or Leonardo da Vinci, or of such painters as Rembrandt and Rubens—are not usually understood or appreciated by young children, especially when reproduced in half-tone without colour. These are mature adult works, riches which should be held in store for later years and not dissipated by a familiarity which will almost certainly breed contempt.

The subject-matter of a picture plays an important part in children's taste. Pictures should be chosen from the works of genuine artists, both of the past and present, who paint the kind of subjects that children like—scenes from the lives of saints and heroes, pictures of angels, animals, processions, fêtes and festivals, or of daily life through the ages. Children greatly enjoy works of the Italian primitives who use an unsophisticated language with which they are themselves familiar. They are naturally attracted by both the subjects and the treatment of the Florentine and Siennese painters of the fourteenth century. In Fra Angelico they see a faith as simple as their own combined with a lively fancy and perfect colour. Uccello, using an almost two-dimensional decorative convention which children understand easily, gives them stirring battle pieces in which the glamour of mediæval times is splendidly displayed. Mediæval manuscripts, Calendars, Chronicles, or Books of Hours are often illustrated by charming pictures of daily life, the Seasons of the Year, or Scenes from the Nativity, which are most suitable for children. From these they may learn, too, that picture-making in this country began with the illuminated manuscript where the decorated capital letters often had

figures painted within the letter itself. These miniature pictures gradually became more elaborate and increased in size until the whole page was covered. This was the beginning of the beautiful illustrations to missals and calendars which were especially painted for famous men and women or the rich patrons of the day. Reproductions of these illustrations can be bought at the British Museum at very reasonable prices. See the list at the end of this chapter.

It is equally important that children should be familiar with the work of contemporary artists, either in the form of reproductions or, better still, as original paintings or lithographs. Etchings and engravings are not so suitable. It is worth while making an effort to borrow one or two original works from time to time, for it is certain that an actual oil-painting, water-colour, coloured print, or drawing is worth many a reproduction. Only in this way can the child appreciate the peculiar qualities of the different media and their influence on expression. The pictures that we shall choose for the classroom will, of course, include the children's own work. Their gay and lively pictures make perfect decorations for the classroom, hall, or corridor. As there will be a continuous supply of good paintings from this source, the school should have a changing exhibition of pictures at all times. The framed pictures and posters that are chosen for the school should be moved around each half-term and changed altogether from time to time, otherwise they will be taken for granted just as are the window blinds or radiators. It is always difficult to procure reproductions of old or modern masters at reasonable prices, so that postcards or book illustrations must often be used. With large classes these may be projected on a light wall or screen by means of an epidiascope. This is a most satisfactory method, which may be used two or three times during the term for short intervals only, not more than six or seven pictures being shown at a time. Otherwise a few postcards or other reproductions may be displayed for a week or two, so that the children will have an opportunity of looking at them whenever they are free to do so.

Looking at Pictures

When we talk to the children about a special picture, our main object will be to show them how to look at it. We may tell them that the artist has a message for us, he is telling us about the subject that he has chosen and also what he himself feels about it. To enjoy pictures fully, we must do more than glance at them; we must learn to look at them and to search for the message that the artist has to give. When we have given the children a chance to look at and comment upon the pictures for themselves, we may begin by explaining the subject to them. This is what they will want first. The subtle points that lie hidden within the subject-matter will only have some meaning for the child if his natural curiosity has first been satisfied. Before we look at the picture in detail, we may tell them briefly a little about the artist and the times in which he lived. Then we shall encourage the children to discuss the picture further. Finally, we shall tell them what it is that we think the artist is trying to say, and something of his treatment of the subject. An excellent picture for this pur-

pose is "The Vision of St. Eustace," by Pisanello, which is in the National Gallery (No. 1436) (Plate XV). We could describe it to the children in the following way:

"This picture is called the 'Vision of St. Eustace'; it tells us of the wonderful thing that happened to a rich nobleman while he was hunting."

Here, the teacher may tell the story of this well-known legend in more detail. "This picture," we shall continue, "was painted a long time ago—over five hundred years ago—by an Italian painter called Pisanello, who worked in Venice. We can see that this artist loved to draw and paint animals; perhaps that is why he chose this subject. He has made his picture into a wonderful pattern of animals, rocks, trees, and flowers. If you look carefully, besides three splendid stags you will see a doe and a fawn among the rocks on the top left-hand side of the picture, and on the right a wild bear. You will notice that there is no sky in this picture; instead, the artist has chosen to paint the landscape as if he were looking down on it; at the top he has put a lake of clear greeny-blue water with different kinds of white water-fowl upon it. Down in the right-hand corner he has painted some of the little birds of the forest fluttering from tree to tree. In this painting Pisanello has told us a great deal about the times in which he lived—about the wild creatures that were to be found in the forests, the clothes that it was fashionable to wear for hunting, the breed of horse and kinds of hounds that were used. But as well as all this he has told us something about the behaviour of the animals in these peculiar circumstances. For instance, we can see that they are a little afraid of the strange stag and do not attempt to attack, while the stag himself is calm and unafraid as if he knew of the Wondrous Cross that he bears between his horns. On seeing the stag, the horse begins to back away of his own accord. Two of the hounds look puzzled, while the third sees the vision and growls with raised lip. In the foreground the little pair of terriers have noticed nothing unusual, nor has the greyhound which, having picked up the scent of a hare, is seen chasing it into the forest at the edge of the picture. This artist, who can tell us so much about the behaviour of animals, can tell us even more about St. Eustace himself. From his fashionable clothes and the trappings of his horse we learn that he is a rich man. His undercoat is of fur, his strange but fashionable hat and his jacket are of the finest materials, a silver-mounted bugle hangs at his waist from an embroidered baldric. From his sensitive face and finely made hand—no ordinary workman's hand—we see that he is of noble birth. As we look again at this intelligent man with his hand raised in astonishment, we may wonder what his thoughts are; already in this first moment we see that he is deeply affected by his vision of Christ.

"By the way in which the craggy cliffs and thick tangled trees are drawn, the artist tells us about the wild and lonely countryside. By arranging the rocks in a pattern that leads always to the centre of the picture, he holds our attention on the figure of the Saint, leading it from there across the backs of the hounds to the stag with the Cross. We shall notice that the stag and the horse and hounds are much larger than the trees. The artist felt that this was right, both be-

cause of the story and because of the arrangement or design of the picture. He is not concerned to describe everything as it appears to him, only some things; he tells us most about the things which seem to him to be the most important—about St. Eustace and the vision that he saw; other less important things, like the trees, he only mentions in passing. Another way in which the artist draws our attention to the important parts of the picture is by making the background very dark. In this way the Saint and his horse and the vision of the Cross show up light against the dark. We cannot help feeling that Pisanello enjoyed his idea of making the shape of the scroll that he has drawn in the front follow the interesting shape of the greyhound just above it. This charming picture is to be found in our National Gallery, which is one of the finest picture galleries in the world. It costs you nothing to go in; the pictures belong to all of us; they are part of our great heritage."

HOW TO USE STILL-LIFE GROUPS

From time to time a still-life group which we ourselves feel to be paintable may be arranged for the benefit of the older children (10 and 11). We shall notice that these children are beginning to add factual information to their pictures—the result of direct observation of nature. In their pictures of steamers, for example, the familiar symbol with its large funnels and numerous portholes is replaced by a real ship with carefully observed details. The picture may even be a portrait of a specific ship. In short, these children are beginning to look about them and to concern themselves with the appearance of things. Since this interest in an object for the sake of its appearance is one of the preoccupations of the artist, we should make the most of our opportunities by encouraging the child to look at objects about him with the painter's eye, at an age when he is naturally disposed to do this. Since this passage from symbolism to realism is bound to become more pronounced in later years, we shall also help to bridge the gap between the Junior and Secondary School if at this stage we encourage the children to look at and observe from nature, even though they are often too young to benefit from drawing directly.

Sometimes it is possible to arrange a group on a table or desk, where it will remain untouched for a few days. For our purpose these should be groups of such coloured objects as will catch the child's attention and delight his eye—painted wooden toys, tea-sets, dolls, spinning-top, Noah's ark, shells, flowers, fruit, berries, branches, leaves, bracken, stuffed birds or fish, feathers, fishing-floats, musical instruments, glass retorts filled with coloured water. (Cubes, cones, spheres, and other apparatus which are used for exercises in drawing should never be seen in a school for children; they belong to the art school.) A few objects such as those listed above may be formally arranged against a suitable background. The purpose of the background is to set off the objects by contrast; strong contrasting colours are often used to advantage. Pieces of drapery, either plain or patterned, may be used so long as the pattern is not too insistent, in which case it may camouflage the objects instead of showing them up. If the group of objects is itself brightly coloured, a very simple background made of ordinary cartridge or pastel paper will look well. These

may be used, too, to cover the surface of the table upon which the group is set up. Good backgrounds may be made out of the children's own work if the pictures are large enough. A seascape would make a good background for a group of related objects such as a toy sailing-boat and shells of different sizes: or again, a distant landscape might enhance a flower piece, a stuffed bird standing among leaves and ferns, or a doll's picnic-party. There are many fine posters designed by artists for the Underground railways which can also be used in this way.

There should be no suggestion from the teacher that the children ought to sit down in front of the group and copy it. It is there primarily to be looked at and enjoyed. If the children like it, they may make pictures of it, which, if not directly resembling the group, will have been inspired by it. They may paint "round" it, that is, putting in some of the objects that are in the group, leaving out others and making additions of their own.

Some children may express a definite wish to paint the group. Since we do not want them to attempt anything in the nature of a study or realistic painting, which would be far too difficult for children of this age, we may suggest that they should look at the group for a few minutes and then go back to their places in the classroom and paint the picture out of their heads. This will prevent their attempting to sit down in front of it and "copy" it or make a "likeness." For it is not the ability to copy accurately, but the vision of the inner eye that we wish to encourage. We may try to explain to a few children who seem to be interested and ready for such information, how we came to choose the objects for the group, arriving at the result by an accident of colour or shape or constructing it with careful thought, round a "setting" such as has been suggested above. It is a good plan, too, to let the children help to put up a still-life group, or to give two or three of them a number of suitable objects and let them put a group together by themselves. The older children may then be invited to say how far this will be suitable for picture-making.

How to make use of the Collecting Impulse

In contrast to the formally arranged group of objects which are meant to be looked at but not touched or moved, a collection of small objects whose purpose is to stimulate the sense of touch may be supplied. This miscellaneous collection will be different from those found in museums; there, classified objects of special value may be seen but not touched. Our collection will consist of objects of no apparent value, which display a great variety of different textures and invite touching. Tram tickets, pebbles, a pretty button or a piece of broken crockery—such things may be found in any small boy's or girl's pocket, for most children are collectors on their own account, and will often bring their treasures to school for us to admire. These "pocket" collections will form the basis of our museum; the children may be invited to lend some of their treasures for a day or two to the collection for the benefit of all. We shall find that they will constantly be contributing to a changing collection to which we shall be able to make all sorts of additions ourselves.

Any of the following things will be

found useful for beginning a collection of this kind:

Natural objects.—Dried or everlasting flowers, lichen, skeleton leaves, teasels, oak apples, oak galls, chestnuts, acorns, beech masts, the fruits of the lime, sycamore, and alder; old birds' nests, birds' eggs, and butterflies; objects which have been weathered or washed smooth by the sea, such as cork, curiously shaped pieces of wood; pebbles, glass, amber; shells, dried seaweed, crabs' claws and cast-off shells, sheeps' wool, silkworm silk, feathers; bones, meteorites, fossils, flints.

Man-made things.—Early stone implements, arrow-heads, scrapers, shards; small pieces of machinery, cogwheels, spindles, bobbin spools, springs, pulley blocks, ball-bearings; magnets, cartridge cases, old violin strings, the reeds of wind instruments, pieces of vellum.

This kind of collection is best displayed in shallow wooden trays, such as those used for Plasticine, and may be kept on a desk or wide window ledge low enough for the children to reach. Whenever they have a few minutes to spare, a few of them should be allowed to play with the objects that are displayed. Opportunities for this will occur from time to time during the art lesson. When a child has finished his painting and there is not sufficient time for him to begin another before the lesson ends, he may look at any new pictures or still life there may be, or examine the latest additions to the collection. Sometimes, too, it may be possible for him to do this on arrival in the morning, between lessons, or during break on wet days. It is often impossible to have such a collection permanently on show; then it must be kept in boxes and displayed at suitable times during the week. If there is no other available desk to put it on, the teacher's desk must be used.

Our attitude towards the collection will be that of curators. We shall regard the things that are of value to the child as being of value to the collection; for though we may often wonder what it is that a child can see in a bomb splinter or an elastic band, it is this very interest in an object for the sake of its appearance or texture apart from its association or use value that we wish to cultivate. The general orderliness of our room will not suffer so long as proper provision is made for housing the collection. Just as we shall not expect our children to be completely silent when they are painting, so we shall not expect our classroom to appear meticulously tidy. A sense of orderliness should underlie our activities without restricting them. An atmosphere of calm and ordered activity will exist only if we have made some workable plan for the distribution and collection of materials. Tools and other apparatus should be kept in clearly labelled boxes so that children can learn to help themselves and replace the things after use. For our part, we shall see that teaching material that is no longer needed is not left upon walls or notice-boards, and that unused boxes or discarded cardboard models do not clutter up the tops of cupboards or shelves.

In a separate box, samples of material may be kept—velvet, corduroy, felt, crêpe-de-Chine, satin, tulle, lawn, cotton, poplin, tweed, flannel, broadcloth, linen, gaberdine, net, lace, hopsack, calico, braid. These may be collected from tailors or dressmakers' patterns, and snippets, or from our own

mending-bags. This box of bits will also be found indispensable for any appliqué work that is done. Those of us who have taught poorer children know how they love to finger and stroke materials of a fine quality and notice the clothes that we wear ourselves. Fur or pigskin gloves, or the wool of a fine Shetland scarf, would give these children great pleasure if they were allowed to touch them. Their lives have often been starved of these small refinements and luxuries which others so easily take for granted.

Children of seven and eight who are too young to appreciate the pictorial qualities of a still-life group may be introduced to the "painter's view" by arranging flowers in the classroom. Both boys and girls like to do this. If they live in country districts, they will be able to bring flowers, together with leaves, ferns, branches, berries, and fungi. With these children flower arrangement can be made a definite part of the art lesson. In large classes the children may take turns at arranging and caring for the flowers each week so that they always look fresh and form a considered part of the decoration of their room. Some children have a natural feeling for flower arrangement, others need more than a little help and encouragement. They have a tendency to cram the flowers into vases in tight bunches exactly as they have been picked. The teacher should show the child how to create new and delightful juxtapositions of colour and shape by, for example, cutting down flowers to heights which will help to compose the whole shape of the bunch, or so arranging them that the flowers become related patches of colour. It is often necessary, too, to remove superfluous leaves or shoots, only allowing to remain those which are really needed for purposes of colour or composition. The heads of a mixture of summer flowers may all be broken off very short and floated in a shallow dish or large saucer. Flowers of snapdragon, pink, nasturtium, petunia, verbena, and sweet william will provide as brilliant a mixture of colours as a painter's palette. The little flowers of roadside, field, and lane—speedwell, eyebright, stitchwort, ladies' slipper, herb robert, and others, look well arranged as tiny posies in potted-meat jars or eggcups. In this way we shall teach children to think of flowers and plants as materials for use, with the creative possibilities that paints have for a painter.

It is unnecessary to have elaborate vases which are not in themselves a good shape; glass jam jars of different sizes or a large well-shaped milk-jug will do very well; nor are expensive shop-bought flowers in any way essential. Country children have, of course, a great advantage over those living in towns, but many beautiful and interesting plants may be found on waste ground or on the river and canal banks of our great cities. Here are some suggestions: On waste ground—ragwort, bracken, willowherb; on river or canal banks—hemlock, cowparsley, giant angelica, teasels, rushes; on railway embankments and other unexpected places—coltsfoot, appearing early in the year when flowers are scarce, and bindweed, which is equally beautiful.

Many vegetables can be used for decoration: leaves of cabbage, especially the red variety, or celery, with its decorative bleached leaf, and onion flowers, when they are not wanted for seed. If the tops of carrot or turnip

roots are sliced off and grown in shallow dishes of water, they will sprout young feathery leaves which, together with sprouting acorns, grasses, or peas, can be used for making miniature gardens.

This training in the handling of flowers will be far more likely to inspire than the usual direct method of sitting down to copy a solitary specimen.

In the rush and stress of life today, when a good deal of effort is expected of the child at school, while conditions at his home and in the world are generally so unfavourable, the teacher of art is perhaps the most able to provide an atmosphere of peaceful activity for him—a time to be spent in creative leisure, which, though it may appear to be mere waste, is, in reality, a most necessary and valuable part of what we mean by education.

Children of Junior school age will enjoy the works of the following artists:

ITALIAN SCHOOL: Giotto, Lorenzo Monaco, Fra Angelico, Uccello, Gozzoli, Botticelli, Duccio, Simone Martini, Gentile da Fabriano, Pisanello, Carpaccio.

FLEMISH SCHOOL: Jan and Hubert van Eyck, Memling, Pieter Brueghel, Mabuse.

DUTCH SCHOOL: David Teniers, Jan Steen, Pieter de Hooch, Jan Vermeer.

FRENCH SCHOOL: Vincent van Gogh, Paul Gauguin, Claude Monet, Henri Rousseau (dit Le Douanier), Marie Laurencin, Marc Chagall.

ENGLISH SCHOOL: Nicholas Hilliard (English Miniature Painters, King Penguin), Richard Alken, George Stubbs, Benjamin Marshall, Thomas Bewick (Selected Engravings, King Penguin), Sir John Millais, Dante Gabriel Rossetti, Christopher Wood, Edward Wadsworth, Stanley Spencer, Edward Bawden.

ILLUMINATED MANUSCRIPTS AND ILLUSTRATIONS: Froissart's Chronicle (Harley MS., early fifteenth century, French—British Museum).

Sforza Book of Hours, sixteenth century, Flemish.

Les Très Riches Heures du Duc de Berry (Verve. No. 7, 1940).

The Seasons of the Year (Grimani Breviary—Batsford).

Persian and Indian Miniatures, Chinese Paintings of Animals and Flowers (British Museum).

Art of the Far East (Batsford).

TAPESTRY: The Bayeux Tapestry (French) (King Penguin).

"La Dame à la Licorne" and other French tapestries of the fifteenth and sixteenth centuries.

RECOMMENDED BOOKS: Discussions on Art (Avalon Press and Central Institute of Art and Design). A well-illustrated series covering many schools.

The Faber Gallery (Faber & Faber). Each book in this series contains ten or more colour plates.

Masterpieces of Flemish Art. (One of a good series published by the Falcon Press.)

Art Books of the Phaidon Press.

The World's Masters. A pocket series (Studio).

Art for Children (Berry—Studio).

King Penguins.

Penguin Modern Painters.

REPRODUCTIONS: Postcard and larger reproductions of many pictures and other works of art may be purchased, at cost price, from: The National Gallery, Trafalgar Square; The Tate Gallery, Millbank; The British Museum; the Victoria and Albert Museum, South Kensington.

CHAPTER NINE

BEGINNING AND FINISHING A PICTURE

IT has been said earlier (Chapter III) that various methods have been evolved for restoring the child's confidence in his own power of expression.

This self-confidence, and belief in the value of what he has to say, and in the rightness of his own way of saying it, are necessary if the child is to do good creative work. Fear of authority, of ridicule at school or at home, fear that his efforts will meet with disapproval or unfavourable comparison, all contribute towards the lack of self-confidence from which many children suffer; to a lesser degree, the fear of making a mess, of going "over the edge," of not being able to get his drawing "right," will also help to cramp and restrict his powers of expression. Just as fear and meaningless restraints will hinder the natural growth of the child's personality, so they will inhibit the flowering of his ideas. We shall hear the familiar cry of "I don't know how to begin" or "I don't know what to do."

Children do not all respond in the same way; many teachers will be able to find other means than those suggested below, which, while freeing the child from restraint and anxiety, will also contribute towards the gradual building up of his self-confidence.

It is clear that before any method can be successfully applied a satisfactory relationship between teacher and child must have been created. The nature of this rapport will be that of a partnership in which trust and respect are mutual. It is by anticipating the child's difficulties and presenting them in a way in which he can easily surmount them himself that we shall best be able to re-establish his confidence and renew his appetite for personal exploration.

Some Ways of Restoring Confidence: 1. Pattern

As has been suggested in Chapter III, pattern-making is always one of the most effective methods for reviving the child's creative powers when these have been damaged. Pattern-making is an essential part of the development of children's art, and is the foundation of good picture-making. For this reason it will be found to be beneficial to return to the pattern intermittently throughout the years of childhood. From time to time we shall find children in our classes who for one reason or another have missed out this important part of education. Until this stage of development has been fully experienced, the continuity of their emotional and intellectual growth will be hampered. Different ways of making patterns have already been mentioned

in Chapter IV. Freedom of expression is probably acquired most quickly by the method known as "taking a line for a walk." This has the additional advantage, in this case, of requiring little or no skill in drawing, while it develops the colour sense rapidly, and the free handling of paint is a source of pleasure to every child. It will not be necessary to describe this method in detail here, as this has been done in Chapter IV.

Some children whose creative powers have not been entirely dried up will benefit from the limitations and discipline of the more formal type of pattern which is built up from simple geometric shapes or letter forms. While young children will do well to begin with the simplest forms and go through all the early stages fairly rapidly, older children will be reassured by beginning with some simple, almost fool-proof method of producing pattern, such as printing from potato cuts. Once the principles of pattern-making have been grasped, the child may proceed to the less mechanical methods, first combining brushwork with the print and finally drawing simple repeating forms directly with a brush.

In this way he will gradually be weaned from his dependence on the automatic formation of the printed pattern and will gain in confidence when he finds he can make a pattern just as well himself.

2. Funny People

A method which is most useful, particularly when dealing with a whole class of children who seem to be unable to begin working in the normal way, may be called "Funny People." These are simply fantastic or comic figures which the children invent as they go along. For this purpose we shall supply them with large paper, such as sheets of *The Times*, and insist that they paint the figure directly on to the paper with a large brush, choosing any colour they like and painting very thickly. This is ostensibly to cover the print, if news-sheet has been used, but actually to ensure that they use strong, definite colours instead of the feeble, transparent washes to which they are inclined. We shall make sure, too, that the figures are large by telling the children to put the head right at the top and the feet at the bottom of the paper. If they all do this, the figures will be about the same size and the pictures may then be joined together to make an amusing frieze with which to decorate the classroom. This will please the children and will also help to raise their morale. Some children may be unable to paint even "funny" people and unable to invent clothes for them. We may then suggest that "funny people" are all colours and shapes, some short and fat, some tall and thin, some dressed like clowns with ruffles and large buttons, some looking like scarecrows in battered hats and tattered coats. Our attitude towards these paintings should be encouraging and entirely uncritical. The object of the lesson is not to get the child to paint realistically, but to get him to cover a large area with paint rapidly, so that he himself is impressed by the magnitude of his picture and the ease with which he has produced it. By appealing to his sense of humour, or his primitive enjoyment of the comic or grotesque, we shall help him to become less aware of his surroundings, to forget himself and begin to paint with enjoyment. When the broad outlines of the figure have been

painted, we may suggest some simple ways of decorating the background. A quick, effective pattern of dots, waving or zigzag lines, stripes or checks, painted directly with a large brush, will help to fill it in. If some of the children have painted the background in their own way, we shall look upon this as a good sign and shall not interfere. Similarly, the "funny people's" clothing may be decorated in all sorts of ways. Patches on a coat, stripes down the side of a trouser leg, embroidered belts, crosses, waves or zigzags in different colours, scarves, coloured waistcoats, feathers, ribbons, or buttons, are all easy to paint, and will help the children to make their pictures very complete.

Edward Lear's poem *The Quangle Wangle's Hat* appears to have been written almost especially for our purpose. In this poem we shall find a wonderful description of a nonsensical hat; we shall make the most of the lines "But his face you could not *see*, On account of his Beaver Hat." It is exactly what is needed for this particular lesson. To the child who says, "I can't draw faces," we shall say, "Here is a piece of paper, will you draw the Quangle Wangle's hat for me? You see, his hat was so big that no one could see his face at all, so you won't have to draw it, but you must draw a very big hat." Many of the other characters in Lear's Nonsense Songs and Limericks are equally improbable and obviously intended for "funny people."

The Pobble who has no Toes.
The Dong with a Luminous Nose.
The Jumblies.
Uncle Arly.

3. Funny Animals

Another rather similar method which may be used as a refresher at any time or for "limbering up" children at the beginning of a term is called "Funny Animals." This requires a little more skill and a more lively imagination than Funny People. The animals are invented in the same way as the figures, the parts of different animals being joined incongruously together, as in the game "Heads, Bodies, and Tails," to make the "Animal that Never Was," as the children have christened it. If we suggest such possibilities as "ducks with dog's feet" or "dragons with tufted ears and beribboned tails" to the children, they will soon be inventing equally unusual creatures for themselves, and may be able to add appropriately fantastic landscapes as well. Here, too, Lear will be able to help, for the party which was held on the top of the Quangle Wangle's hat included: the Attery Squash, the Bisky Bat, and "the Fimble Fowl with a Corkscrew leg." These creatures should be drawn large enough to fill up the paper. It will be less possible to make a frieze out of this set of work, but the children will enjoy trying for the "most peculiar animal" competition.

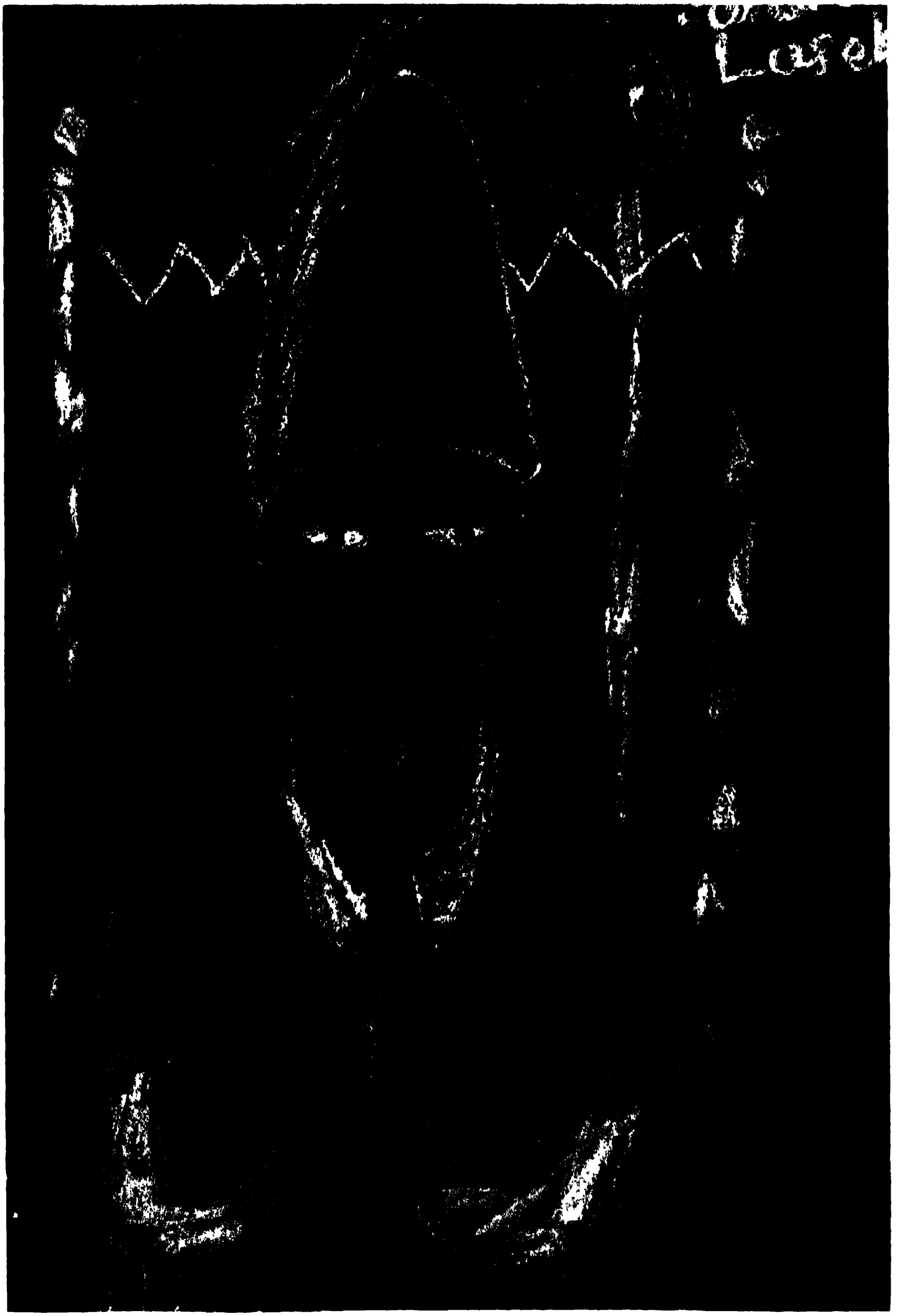
4. Developing the Picture by Stages

Another method which will help to give the child confidence consists in asking him to begin by drawing anything that he can do easily; it does not matter what subject he chooses, so long as it is something that he feels he can do, however small it may be. He may choose to draw a ship, a house, or a motor-bus—whatever he fancies. When he has finished, two alternatives lie before the teacher. She can either

PLATE XVII

BOWL OF FLOWERS (Girl $7\frac{1}{2}$ years) Size 23 in. × 18 in.

PLATE XVIII



THE BISHOP (Girl 10 years) Size 20 in. × 15 in.
Drawing on black paper with blackboard chalks.

FLOWER PATTERN (Girl 9 years) Size 19 in. × 13 in.

This picture is an extension of "Taking a Line for a Walk." The pattern is developed round the flower shape. The paint is rich in quality and texture.

PLATE XX

SYRINGA (Girl 10 years) Size 18 in. × 14½ in.

The white star-like flowers shine against the dark background

PLATE XXI

WATERWAYS (Boy 12 years) Size $20\frac{1}{2}$ in. × $15\frac{1}{4}$ in.

This painting by an older boy shows direct observation. He has the painter's eye for the essential character of objects

PLATE XXII

PEASANT GIRL (Girl 7½ years) Size 29 in. × 21 in.

The traditional decoration of Central Europe is clearly shown in this lovely painting by a child of Czech parentage.

PLATE XXIII

(*a*) THE MAIDEN ALL FORLORN
(Co-operative work by girls aged 11 years.) Size 22 in. by 15 in
See *The House that Jack Built*, p. 254 and Plate XXVI (*a*)

(*b*) THE BEEFEATER (Girl 11 years) Size 22 in. × 15 in.

PLATE XXIV.

(*a*) FLOWERS Lino-cut (Girl 10 years)
Size 6 in 5¼ in.
See reference on p. 262

(*b*) ELEPHANT IN THE JUNGLE Lino-cut
(Girl 6 years) Size 5½ in. × 4½ in.

(c) COCK Appliqué (Girl 9 years) Size 8½ in. × 8½ in.

help the child to make a good picture out of the one he has begun, or she can choose some detail from it and help him to use this as the main theme of another picture.

If the child has produced a picture which shows signs of coherence, but at the same time is very incomplete, the first method may be used, but if the first picture is either very feeble or is full of slick tricks and second-hand ideas, which do not reflect the child's own mind, then the second method will be the most effective. Let us suppose that the child has drawn a house with some slight indication of a garden. We shall help him to add to this by suggesting paths, a surrounding fence or a hedge with a gate, and a border with flowers. At the next lesson we may say, "Well, are you going to paint another house and garden?" If he agrees to this plan, we shall suggest that he might draw a rather larger garden so that there is room for more flowers, curtains may be added to the windows, or smoke to the chimneys if he has not already done this. In this way the child begins with something that he is sure he can do, and gradually builds the picture up, developing it a little farther each time. This process is slow in so far as it is often a long time before any results are apparent, but by gradually drawing the details in the foreground and proceeding to those in the background, the distance, and the sky, the child will be learning a great deal about the structure of a picture. Quite unexpectedly he may one day paint a picture of some entirely different subject with a sureness that will show how much he has been unconsciously absorbing during the past months. At some point we might suggest that another house could be added to the first, and eventually by this painless method a whole street will have been constructed before the child knows what is happening. The church, the shop, the school, the pond, and the doctor's house may be added to the street by degrees, while in the hills behind the village the farm with its sheds and barns will appear, and the chequered fields with the various patterning of their crops. In the town, buses will appear in the street, together with the fire station, the pub on the corner, the distant church spires, or factory chimneys.

It remains to describe the way in which these different methods can be applied to three different types of children:

The timid, sensitive child.

The aggressive and non-co-operative child.

The child who is willing and co-operative, but has no confidence in his own ability.

(1) The timid child will need a great deal of encouragement and reassurance. It has been suggested in Chapter III that it would be a mistake to expect a child of this type, who is already anxious, to launch boldly forth on to a sheet of clean white paper; moderately sized toned paper will be less frightening at first. We shall see that he is provided with a suitably sized brush, neither too large nor too small. This is the child who should begin by doing whatever he has done before and can already do easily. If he sees that nothing very alarming is expected of him, he will feel less anxious and more sure of himself. The method which has just been described, in which the child's original picture is developed

gradually, may be used for the first few weeks. If, on the other hand, he is unable to produce any kind of picture, he had better begin by "taking a line for a walk." In any case, he will derive great benefit by practising this method of pattern-making during his first term and at intervals throughout the year. It is essential that he should be encouraged and given the opportunity to make a legitimate mess—to go over his own lines deliberately if he feels inclined. However poor and feeble his first efforts may be, we shall show nothing but approval, though at the same time our approach must be cautious and unhurried. It will be wise to let him find his own feet at first and watch him unobtrusively, and anticipate his needs rather than to overwhelm him with help and enthusiasm. We shall feel that he is beginning to make some progress when we hear him laugh out loud or see that he is being mildly naughty.

(2) The aggressive child is more difficult to deal with, especially as he grows older. He is probably "up against" authority as represented by his teacher. He will very likely be unwilling to co-operate, and will appear sullen and suspicious. The second method, "Funny People," will be the most useful for him. Here he can safely let himself go on a large sheet of paper with a large brush and plenty of thick paint. He may like to do a "funny" picture of his teacher, his father, or a policeman, or any other figure that represents authority, or he may simply enjoy himself by painting comic people. If we have been able to persuade him to paint a figure fairly successfully, this lesson may be followed by some exercises in formal pattern-making, returning again to a figure or perhaps "Funny Animals" at the end. If he is unable to make very much of the figure the first time, he may be introduced to the method "taking a line for a walk." He will probably derive a good deal of satisfaction from handling paint in this free and sensuous way and may return later to painting "Funny People," to be followed in turn by patterns which are made by the repetition of geometric or letter forms or by potato cuts. This kind of child will be troublesome if he is bored. Our purpose, then, is to stimulate his interest by giving him exercises in which a spectacular result can be rapidly achieved. As soon as he begins to enjoy his work, he will become interested in it in spite of himself.

Since the more formal types of pattern-making require some concentration and persistence, we shall not make use of them until the child shows signs of being interested in the work that he is doing and is willing to co-operate. The day will come when this child will want to consult his teacher about a problem in some such words as these: "Do you think pink would look nice there?" or "Shall we have a double line of curves at the bottom of this page?" When this happens, we shall know that a workable relationship of mutual trust is growing up between the child and teacher. This is the basis from which good work will ultimately spring.

(3) Then there is the child who is good-natured and amiable, but at some time he has been told that he can't draw, and consequently he has no belief in his own power to do so. Because he is well disposed towards those in authority he is quite willing to fall in with any scheme that may be suggested; he presents far less of a prob-

lem than the other children who have been described. He may be found sitting at the back of the class doing absolutely nothing, though he will jump up with alacrity to run an errand or wash-up or tidy a cupboard. Any of the methods that have been suggested may be used to help this child, but "Funny People" will probably be the most effective. He will enjoy himself doing this and will gain confidence rapidly, though it will take a little time to eradicate the impression that "he can't draw and therefore need not try." As soon as there are definite signs of returning confidence, we shall plan to keep his interest by giving him plenty of work to do. If, for example, he has chosen to paint a Funny Clown in one lesson, we shall tell him to make a picture of "Two Acrobats on a Tight Rope" in the following one. These, we shall explain, must be made to fill the paper just as the clown did. He will have to think what people look like when they are balancing or when they are about to fall. He may make them look as funny as he likes and paint any kind of background behind them. Designing two large figures together in a given space will give the child something to think about. We shall help him best by making him paint vigorously until the picture is finished. The formal pattern will be of more use to this child than the free, since the mental effort which this entails is what he needs. So long as he is not given work which is beyond his capacity he will get personal satisfaction from the sustained effort.

Finishing a Picture

During the term we shall often have to decide whether a child has finished a painting and ought to begin a new one, or whether it would be advisable to encourage him to continue working on a picture which he began earlier. A painting may be said to be finished when a complete statement has been made. The nature of this statement will depend, among other things, on the age of the child. We shall not expect a child of five to develop a picture in the way that an older child will be able to. The young child makes a simple and direct statement of his idea; he often works very quickly and with complete absorption. Beyond requiring a great deal of paper and paint, he presents no problem. For his older brothers and sisters, painting will not be quite such a straightforward process. Between the years of seven and eleven, besides consolidating the early impressions, they are learning to say more about more.

They will be able to enlarge upon their earlier statements, to make a sort of decorative comment upon them. For example, the figure in the picture called "My Mum" will become more elaborate. Decorations will appear on the dress, a hat, a necklace, shopping-basket, or shoe-laces may be added. Gradually the background appears and becomes more detailed, until the child has really said his last word about "Mum" and is ready to turn to some other subject. The rate at which a picture develops in this way from a very naïve, simple statement to a relatively elaborate one will depend on the individual development of each child. As we watch the children at work we shall understand more about the sort of progress that each child is capable of making. By experience gained in this way we shall know when to encourage

him to develop his picture a little farther, and when to accept his statement as final.

Already we have noticed in Chapter III a number of pictures which are not completely covered over with paint. A large area of the original paper may be showing. This does not necessarily mean that the picture is unfinished. It may be a part of the child's intention to leave the paper showing, or he may be "drawing" in paint and be perfectly satisfied with the result. Gradually he will begin to add solid patches of colour to his pictures—a dress, a house, a ship may be filled in first. In later pictures he will begin to paint the foreground, background, and sky, until finally his whole picture is covered. Now that he is beginning to think in terms of paint rather than line, we may urge him to complete his picture by painting all over it, and not to leave little accidental patches of paper showing. It will not follow that, when this stage has been reached, a picture is finished as soon as it is all covered with paint. For some children it will be *begun*; they will have a very clear idea of what they want to do and will go on adding patterns and decorations in various forms all over the picture. (We shall see that the first paint is dry before any additional work is done on the top of it, and that the colour used is thick and opaque.)

Let us suppose that having previously looked through a set of work we are about to return it to the children at the beginning of a new lesson. We shall begin by giving back the work of those children who want to go on with their pictures and who know what it is they want to do. Next, we may collect together the children whose work was really finished at the end of the previous lesson, and give them all clean paper for beginning another picture. Most of these children will know what they would like to paint next, but in case there are one or two who have no ideas, we shall have a few suitable subjects ready for them. All these children should be able to get on with their own work while we give our attention to the work of those who remain. For one reason or another they have come to a standstill and are unable to finish their paintings. A few will say that they simply do not feel able to continue, but most of them will be convinced that their pictures are finished.

Here are some typical examples:

(1) The child who has been so absorbed in his painting that he has accidentally left out essential parts of the body, such as arms, a nose, ears, or hair. Or he has left out all sorts of details which he will enjoy painting when they are suggested to him—the flags on a ship, curtains in the windows of a house, lamp-posts or a pillar-box in a street. As we give these pictures back, we shall suggest to each child the appropriate additions that he may make. If we are correct in supposing that he has not yet "said" all he has to say, he will accept our suggestions and go off happily to paint. If, on the other hand, he does not respond, the answer to his problem is not so simple, and we shall have to think again.

(2) There will be the children who have been unable to go on with their pictures because they have lost some of the feeling that they originally had for the subject, perhaps owing to the lapse of time between one lesson and another. By talking to each child about his picture, we may succeed in finding out what it was that first inspired him to

paint. In this way we may be able to revive his mental image.

(3) Next we may find some children who are unable to finish their paintings because they are up against some practical problem; for example, in painting a background behind a collection of objects and figures they may have got into such a muddle that their original conception is completely destroyed. Or their pictures may look messy simply because the colours have been allowed to run. These children need straightforward teaching. We must show them how to handle their materials adequately and to gain control over them (see Chapter VI). With some practical help they may be able to complete their pictures satisfactorily. Sometimes it will be better for a child to begin again, and this time we shall give him the help that he needs before he gets into a mess. It may only be necessary to say, " Wait, paint another part of your picture while that piece dries. You remember what happened last time! " We shall be able to judge, too, whether the child is attempting something that is too difficult for him. For example, we may be able to help him by suggesting that he might find it better to draw one or two larger *soldiers rather than forty very small* ones. Children are naturally unwilling to continue to struggle with a picture which is apparently a failure. We must be prepared either to help them repair the damage, or, if they start afresh, help them to avoid making the same mistakes a second time.

Older children may be dissatisfied with their work because it falls short of some adult standard that they have in mind. They will begin to wonder why their house or table does not look " right "; they become extremely critical of their own work and may even begin to copy from other pictures. It may be that this is the moment to introduce perspective in its most elementary form. If the child is reaching out towards this knowledge, he will be able to absorb and make good use of it as an aid to expression (see Chapter VI).

Another way in which he may be helped will be through a complete change of medium, particularly if this makes no demands upon the representational aspect of picture-making. Modelling or carving (plaster, soap, or salt), built-up paint and paper collage, cut paper, appliqué, pattern-making by means of potato or stencil cuts will all help to restore the child's confidence in his own ability and will teach him, too, that art is not dependent on the accurate representations of objects. By one means or another we must convince him that it is his way of painting, carving, or designing that we value, that his ideas are worth far more than the second-hand preconceived ones with which he is comparing his own work.

(4) Many of us will be familiar with the type of child who is unable to finish off any piece of work which he *begins. He is always sure that if he made* a fresh start he would do a much better picture. Dissatisfied with his own result and unsure of himself, he flits about the class, giving advice to others to bolster up his self-respect, instead of attending to his own work. Left to himself, he will make little progress and will soon become a disturbing factor in the life of the class. Each picture that he paints will reach the same incomplete stage and will be abandoned as soon as it becomes difficult to manage.

The fact that his work is at a standstill will be in itself some indication that all is not well. This kind of child needs firm handling and a great deal of patience. If we allow him to drift from one painting to another without actually teaching him how to overcome his difficulties, he will gradually become convinced that he is " bad " at art, and he will dislike the whole subject. Each time a picture is begun, we must see that he takes it a little farther before he is allowed any clean paper for another picture, and that he experiences more in the making of it. His self-confidence must be built up by easy stages, returning to very simple subjects or, better still, to patterns. Smaller paper will sometimes be an advantage for the latter, as by this means he will be able to complete a sheet of pattern more quickly, but we must insist that, however simple the pattern may be, it is completed down to the last dot or loop before any other work is attempted. The child will be quick to appreciate the impressive appearance of his own work when he has finished it off properly; this, and our encouragement and anticipation of his difficulties, will do much to restore his confidence and whet his appetite for work. Occasionally we shall find that a child who normally does good work is unable to finish a promising painting. In this case it will be unwise to press him in any way. Let him begin some other piece of work which will not take very long, on condition that he returns to the first picture in a week or two. A long lapse of time may make it very difficult for the child to recapture his original idea. A gifted child will respond to tactful, delicate handling; he will work best if he is given the freedom to develop in his own way.

With a little experience we shall know how far a child is capable of developing a picture, and we shall be at pains not to press him beyond that point. The moment that we make the mistake of trying to speed up the natural rate of his progress by pushing him forward to a stage of development for which he is not ready, we shall notice a decline in the quality of his work. His inspiration has been exhausted; in effect, we are expecting him to continue to express himself when he has nothing left to say. Because of this, he will probably busy himself with re-painting parts of his picture and making it look laboured and dull. The lively, spontaneous quality of both line and colour will vanish. Nothing but harm will have been done.

CHAPTER TEN

DRAWING ANIMALS, AND DRAWING FROM NATURE

IN the Junior School, figure drawing, animal drawing, or drawing from nature, whether plant or landscape, should all be approached in the same way, that is, through memory, and not by drawing directly from the model. In this way the child will be drawing from the visual image which he has retained, a process to which he is already accustomed. The difficulties of hand and eye co-ordination, which drawing directly from life involves, are too much for a child under 11 years of age. They will distract him from seeing the figure, animal, or landscape as a whole. We shall find that when he is faced with a model he will draw wildly out of proportion; this is because he is trying to " copy " it piece by piece and is neglecting the essential structure for the incidental details—eyelashes, hair-ribbons, etc. These distractions will also prevent him from thinking of his picture as a whole; in his efforts to get a " likeness " he will forget that whatever he is drawing must form a part of the pattern of his picture. If at any time he does draw directly from the model, we shall see that the pose only lasts for about five minutes, and that the child makes a rapid sketch directly with a brush or charcoal on a large sheet of paper.

Drawing from the figure has already been dealt with in detail in Chapter VII, but it is perhaps helpful to remember that when a child is at a loss in his figure compositions, he can always refer either to his own limbs, or he can look at the other children in the same room, who under the teacher's guidance can often act as temporary models for him.

Animal Drawing

Drawing from Memory and from Photographs

Children love to draw animals; there are several different ways in which we may be able to help them to do this. First, let us suppose that we are in a large town, that it is not easy to have any animals in the school even for a short time, and that the children cannot visit either a farm or a zoo. We shall have to rely on memories of the animals we have all seen, horses, dogs, cats, birds, and perhaps on photographs or drawings of wild animals. It will be necessary to describe the character of the animal in words that will recall its image in the minds of the children; they will be able to contribute to this themselves. If there are children who still have no clear image in their minds, the fundamental shape of the animal may be suggested to them by drawing *in the air* while they watch. For instance, if a child is unable to begin drawing a horse, the following suggestions may be made and illustrated by

movements in the air: "A horse is very easy to draw, he has a long barrel-shaped body like this—his neck is long and rather flat where you pat it, and his head is long and narrow too." We may emphasize this by saying, "A cat has rather a round head; if you think about it, you will remember that a horse has a long, narrow head. His legs are easy to draw—two in front and two behind." Children are sometimes frightened of beginning to draw a horse at all owing to the difficulty they find in drawing the back legs. It is better to ignore this piece of anatomical structure and encourage them to get the essential form down rapidly. By the time the child has painted the main shape of the horse he may easily feel confident enough to continue without any additional help, but if this is not the case, further suggestions may be made: "Don't forget to put in his ears. Horses have small pointed ears at the top of their heads. Has your horse got a long mane, or has it been clipped? Perhaps he would like to have a nice long tail to keep the flies away in summer-time. He will have hooves instead of feet, and you can paint them black."

If it has been necessary to draw on the board or to show the children photographs, these should be explained in order that they may understand the particular characteristics of the animal in question. If, for example, the children are looking at photographs of the giraffe, they will, of course, notice its long neck, but we shall also draw their attention to the following: its sloping back, long delicate legs with white socks and cloven hoof, small cow-like tufted tail, large melting eyes set well towards the back of its head (to enable it to see behind itself as well as in front), long mobile lips (especially made for plucking the leaves upon which it feeds), and a pair of very short horns between its ears. We shall tell them, too, that this lovely animal is not simply covered with spots, his coat is patterned by the shadows of leaves, and when he stands under the trees in his native land he is both decorated and camouflaged.

Before the children start to draw or paint we shall see that our drawings have been rubbed off the board and the photographs put away. Young children should never be allowed to copy directly, nor should the teacher ever draw on their pictures; any explanatory drawings which we do for them should be destroyed as soon as the child has understood them.

Drawing Animals in the Country

Where the school is in a country district there will be ample opportunity for the children to look at real animals. In early summer it should be possible to arrange for a group of children to visit, during school hours, a neighbouring farm; at some time during the Spring term they might go to see the shepherd when he is tending his sheep. Many of the children are so familiar with the farm animals that they never really look at them. A special visit will make the occasion seem important in their minds; for this reason they are more likely to look and to store up images that may be used later in their pictures. As before, we shall help the children to "see" the animals. For example, we may be looking at the sow feeding her litter of piglets as she lies on her side. We shall notice her long, body and short legs, her flopping ears and small

white-lashed eye. We shall comment upon her colour and upon the repeating pattern of the piglets as they feed. We shall notice, too, the patterns that the mixed farmyard poultry make—how the white hens or ducks show up against the warm colours of the farmyard, or the yellow chicks against the dark brown of the hen. A clearer impression will remain in the mind of the child if we show him only one or two aspects of farm life and do not confuse him with too many. Sometimes it is possible to hurry back to the school and let the children draw their impressions rapidly on any cheap paper with charcoal. These "notes" will form the basis of the pictures they will paint in the following lesson. If several days have elapsed between the visit to the farmyard and the painting lesson, it may be necessary to remind the children, by question and answer, of the animals that they saw and the special points that arose in connection with them.

Now that each child has enough information to use, we must see that he sets about "making a picture." Whether we have shown him photographs or live animals, we shall emphasize this essential aspect of his work. We shall explain to him that, supposing his picture is to be a portrait of a hen with her chicks, he must draw the hen fairly large, filling up the space of his paper and allowing the shapes to make the pattern of the whole. He will not be able to put in everything that he saw at the farm; he will have to select the things that will help to make his picture complete.

Drawing Animals in the Classroom

It is sometimes possible to keep some animals in the school for a few days. Rabbits, pigeons, a pair of bantams, or different kinds of mice are all a source of great delight to the children. They act as a tonic to the life of the school and inspire a quantity of vivid and lively drawings. As before, we shall not encourage the children to draw directly from the model. Let us suppose that we have a tame rabbit in a hutch in one corner of the classroom, and that the children are all ready with kitchen paper and charcoal to make drawings of it. By pushing the desks to one side, we shall make a space for the children to sit in a semicircle on the floor; then we shall be able to sit with them, holding the rabbit where they can all see it. We may begin this lesson by showing the children the different parts of the animal and telling them about it in a very simple way. "Do you see how soft and thick its fur is?" we may begin. "At first this makes it difficult for us to see its shape. You will notice the narrow shape of its head, its large eyes and beautiful ears. Here, on its forehead, we can feel the hard bone of its skull under the fur, with the sockets for its eyes on each side. A rabbit is a nervous animal, its eye has a wary look and is set in the side of its head so that it can see easily both in front and behind. In a minute, when we let it hop about, we shall see that it can swivel its ears round separately and listen for the sounds of things that are happening behind it as well as in front. These sensitive ears are especially shaped to catch sounds. What a lovely colour they are inside! It is because it is frightened that its ears are both flattened on to its back now."

In this way we may continue to describe the whole of the animal, drawing attention to its sharp incisor teeth,

the shape of its backbone and ribs under its fur, its narrow chest, the set of its shoulder-blades, and the strong hind legs with which it hops along and thumps signals on the ground in times of danger.

This examination of the rabbit should continue only as long as the children show that they are interested. A very few remarks will be enough for the youngest children, while the oldest may be keen to hear all that we have to tell them. After this we may say to the children: "Now let us see what the rabbit will do if we let it hop about on the floor and give it lettuce leaves to eat. We must all be very quiet, otherwise we shall frighten it and we shall see nothing." Now we shall give the children a few minutes to watch the creature moving about, telling them to try to think how it feels to be a rabbit, for this will help them to draw it later. After a little time, the rabbit will be put back in its hutch and the children return to their places to begin drawing. For the latter half of this lesson they may be encouraged to draw the rabbit in as many different positions as possible, covering both sides of the paper (Plate XXV). At the next lesson various subjects for making pictures may be suggested to them: "My Rabbit," "Feeding My Rabbit," "A Portrait of a Rabbit," "A Wild Rabbit among Ferns and Grasses," "Rabbits and Flowers," and so forth. For these the children may use the quick sketches they have already made, selecting the best rabbit from among them and composing a complete picture around it.

A bird is not so easy to handle, but if it is given some corn or seed to pick up, the children will be able to watch it while it feeds. We shall draw their attention to the characteristic egg-shape of its body, the streamlining of its feathers, its quick movements and thin wiry legs. We shall remind the children that it can turn its neck round in an astonishing way to preen its feathers, and sleeps with its head tucked under its wing. The structure of the wing will also interest the children; we may be able to stretch it out for them so that they can see it both spread and folded. A number of bird subjects are suggested as suitable for making pictures: "My Pretty Dove," "Birds in the Nest," "A Pattern of Birds," "Feeding the Sea-gulls," "A Tree Full of Birds" (as in the old song—*On the first day of Christmas*). Country children may be reminded also of the wonderful snake-like patterns, twisting across the winter sky, made by flocks of packing starlings and other birds. Here, too, is a charming poem which evokes bird images:

"O what if the fowler my blackbird has taken?
(The roses of dawn blossom over the sea.)
Awaken, my blackbird, awaken, awaken,
And sing to me out of my red fuchsia tree."

It will be seen that the more we know about the kind of animals that children like looking at (dogs, cats, horses, rabbits, and so on), the more successful we shall be in helping them to retain and record their visual impressions, since these are most vivid when they are clearly understood.

Drawing from Nature

Much that has already been said about drawing animals applies to draw-

ing from nature. Again our object is to teach the child how to look at nature and record his æsthetic experiences.

Generally there is something paintable to be seen from the windows of the school itself. A backyard with dustbins and milk-crates, or a piece of kitchen garden with washing out on the line, may provide the material for interesting pictures if viewed with the detachment of the artist. From the top windows or accessible roof leads, there may be a fine and unexpected view over roofs and chimneys; the spires of churches, factory chimneys, kilns, gasworks, and water-tower all provide an exciting variety of shapes and colours. Or we may see the roof-tops of a small market town, and beyond it the chequered pattern of the countryside and the line of distant hills. Some of the lower windows may overlook the school playground or its garden, and from these we may see a pattern of boys and girls playing at break-time. Occasionally we can make use of these views by taking small groups of children to look at them and discussing with them the possibilities that present themselves. They will learn that only a section of a panoramic view can be made into a picture; often we cannot even see the whole of it at once. We shall help each child to decide what he will have in his picture while we are looking out of the window together. He will be able to choose whatever interests him most, and later will build up his picture around this central theme either by adding some of the other things which he saw from the window or some which he has imagined for himself. He will not begin to draw until he is back in the classroom again. Often he will make a better picture by starting to paint straight away. If he is watching the other children out in the playground and intends making a picture of them, we may help him to "see" them in the following way: "You can see what a good pattern children make when they are jumping about all over the place. Let us see what they are doing; some are playing 'tig,' a few are running about after a ball over there. Down in this corner the girls are playing hopscotch, sometimes they form a little bunch; they must be telling one another something important. You will notice that a great many children are not doing anything very special; they are just jumping or hopping, bending down to tie a shoe-lace or pick up something, or simply standing around. Some have their backs to us and some are looking this way." By drawing his attention to the different activities of the children in this way, we shall be helping him to remember what they looked like when he begins to draw them later. We may continue: "Those two trees at the end of the yard will be nice to paint - their branches make a lovely pattern. You will not be able to have very much sky in your picture, because this will consist mostly of the playground with the children. You can put in the bicycle sheds, or not—just as you like; from here we can only see one or two bicycle wheels—the rest disappear in the darkness of the shed."

If the school is in rather an unpromising neighbourhood, we may be able to arrange to take the children on a bus to the park, river, or canal; an expedition of this kind will be just as much a piece of education for them as a visit to the museum. Some of them

will see something from which a picture may be made, but others will need help in choosing a paintable subject from amongst the mass of material around them. When we see something which looks promising on the river, we may collect the children together and say to them: "From here you can see the bridge and the bend in the river where the water is shining. The white flag with its red cross on the church tower looks well against the dark clouds over there. Let us watch this tug coming under the bridge and see where we should put it if we were going to paint it" (Plate XXI).

Those of us who are fortunate enough to teach in country districts will be able to arrange to take the children to see places or to describe scenes to them which we have enjoyed looking at ourselves and which we think will interest them. A mill with its pool and churning water-wheel will nearly always be paintable, as will pens of cattle and sheep in the market, the gamekeeper's cottage at the edge of the wood, or the bee man in his outlandish veil beside his row of hives—the subjects are endless. We shall discover different ways of reminding the children of what they have seen, when they begin their pictures at school. Beside the mill, they will hear the babbling or rushing noise of the water at the same time as they see the rippling white-slashed pattern on its surface. We shall remind them of their aural impressions in order to help them remember their visual ones when they come to make their pictures later on.

Whether the children are taken to see the actual place, or whether we describe it to them in class, we must be clear in our own minds about the various pictorial opportunities it offers. We must be able to introduce it to them simply; otherwise the children may feel overwhelmed and intimidated by the quantity of detail they can see or the complicated scenes that we have described for them.

CHAPTER ELEVEN

OTHER WAYS OF MAKING PICTURES

IF art is to become an integral part of the life of the school, the importance of correlating it with other subjects in the school curriculum can scarcely be overestimated. Too often art is used merely to illustrate the English lesson (poetry, stories, etc.). It is equally important to use it as an imaginative expression of something which has already been experienced in another way. The child will form a deeper impression of the subject, it will have become a part of himself if, for example, he has been able to express the idea physically through movement and drama.

The frieze called "Dancing in the Chequered Shade," part of which is reproduced on the folder, was painted by a group of girls, whose ages varied from 7 to 11. These children learned extracts from Milton's poem *L'Allegro* and produced a ballet based upon it. The subject of the frieze was taken from the following lines:

> "*And the jocond rebecks sound*
> *To many a youth, and many a maid,*
> *Dancing in the Chequer'd Shade.*"

The complete frieze is 14 feet 7 inches long and is made up of seven separate paintings. In their poetry lesson the children had formed themselves into groups and joined hands for dancing. In order to show them that the frieze, as well as expressing the dance of the peasants, must have continuity, the children began their painting lesson by standing in a line and holding hands. In this way they could see clearly how the dance could be expressed two-dimensionally on paper. Each child had a piece of grey sugar paper (Royal size) joined to that of her neighbours. They all worked on the floor and were encouraged to stand back frequently to consider the frieze as a whole, and not as separate individual pictures. Each child was told that her area of the frieze was not to be thought of only as a picture in itself, but also as a part of the whole. The child with the strongest personality gradually emerged as leader from among the group of children. She was not the most proficient painter, but she had clear ideas about what was needed, and the other children came to her for advice.

While helping the children to experience the poem more fully, the teacher particularly wished to teach them to think of a piece of co-operative work such as this as a whole. To quote her own words: "The painting of this took five to six weeks (i.e. five to six lessons of forty minutes each) to complete, and in spite of the differences in the children's ages, each figure was related in size to the others and to the landscape behind. A rhythm and pattern of

dancing figures, like a garland of flowers, was carried right through the long frieze, making of the whole an organized unit."

THE HOUSE THAT JACK BUILT

Another and different example of co-operative work was a cut-paper decoration which was made by children of 11 in their first year at a Secondary School. Owing to war-time conditions, these children were working in an attic room of a sixteenth-century house, where heavy oak timbers divided both the wall space and the low sloping roof into small sections of different sizes. It was evident that the room would be less depressing for the children if the plaster panels left between the timbers were decorated in some way. For this purpose the repetitive rhyme "The House that Jack Built" was chosen. It was found that by making a picture of each character and arranging them in the separate panels, the room could be decorated on two sides and its appearance greatly improved. It was thought that a repetition of shapes and the standardization of colours would help to give coherence to the whole scheme. For this reason is was decided to make all the characters, whether human or animal, about the same size, although each one had to be adjusted to fit its appropriate panel, and to cut them out of coloured paper. As only certain colours were available, the range of colour was automatically limited.

The characters of the story each covered the half-imperial sheet of white cartridge paper upon which they were mounted and fixed to the wall; since the plaster was also white, no other background was needed. In the completed decoration each part of the rhyme was arranged in sequence round the room—Jack, the house, the malt, the rat, the cat, etc. All the suggestions were submitted to the class for their consideration, and various experiments were made before the final arrangement was decided upon. The whole scheme took about seven weeks of one eighty-minute lesson per week and consisted of eleven half-imperial panels. Some kind of fancy dress seemed desirable, and Elizabethan dress was decided upon because the children were reading their first Shakespeare play in their English lessons. To fix the scale, the first two figures were drawn out before being cut in coloured paper; after this all the figures and animals were cut directly with scissors. The children worked in groups of two or three; each group was responsible for designing and completing the panel they had chosen to do. The remaining children (there were about thirty in the class) formed themselves into a group for providing many of the additional decorations to the panels—flowers, trees, clumps of grass, butterflies, birds, etc. In order to ensure that each panel was designed as a whole, large portions were cut and arranged before being finally stuck on the paper. Those responsible for the panels applied to the workers in the "factory" when they wanted flowers or trees cut to fill a particular shape.

The conventional forms of the decorations arose partly as a natural result of the direct use of the medium and partly from the inspiration of one child (Plate XXVI (*a*), "The Cow with the Crumpled Horn"), who, having discovered in this medium a form of expression natural to herself, rose to the position of master

craftsman in her relation to the other children. Her interpretation of the medium thus became the mainspring of the whole decoration.

An excellent example of simple co-operative work done by very young children ($4\frac{1}{2}$ to 5) is reproduced on the folder. The subject of this frieze is "Here We Come to the Harvest Festival"; it was made during the children's first two weeks of school life, at the beginning of an autumn term. Each child in the class of forty-two drew a picture of himself coming to school with some offering for the festival. They cut their drawings out and helped the teacher to arrange them on a background of white paper. The drawings were pasted down by the teacher.

Cut paper made the frieze, part of which is reproduced on Plate XXVI (*b*). Here children of 5 and 6 worked together to make a picture of their village street. The success of the scheme is due both to the choice of the subject and to the right use of the medium. The children have obviously enjoyed cutting out and sticking such simple shapes as doors, windows, roofs, or palings. The whole scheme makes a good decorative pattern and shows individual thought and treatment.

It is clear that co-operative work of this kind will make a valuable contribution towards the child's social education, as well as linking his work in the Art Class with many other activities in the life of the school.

Picture-making through Other Media

In the preceding chapters we have seen that paint, with its specially sensuous qualities and infinite variety of colour, is the most suitable medium for picture-making for many children. However, we shall not attempt to limit the child only to drawing and painting, nor to the exclusive use of powder or poster paint and large brushes. While he is young, he should be given every opportunity to experiment with different media, to explore the latent aptitudes within himself, and to practise those activities which awaken and stimulate both the senses and the intellect. For this reason we shall encourage children to work with different kinds of paint, to use inks, charcoal, chalks, and brushes of different sizes and to make pictures through various media. Lino-cutting, cut paper or torn paper, collage and appliqué, are suggested as alternative ways of picture-making for children in the Junior School. Every child will benefit by exploring the possibilities of new materials and handling new tools, but it will be found that lino-cutting and appliqué work are particularly suited to the needs of those children who have lost confidence in themselves as painters. Picture-making will present less difficulties for them if they are able to begin working in a medium which they do not directly associate with drawing.

When we introduce children to a new medium, whether it be clay-modelling, lino-cutting, embroidery, or collage, we shall first teach them to respect the new material and its tools. By "respect" we mean not only that these should be used and cared for in such a way that they perform their functions properly, but that the child must be taught *to think in terms of the material that he has chosen.* "What is important is that the effects of one set of tools on one kind of material should not be imitated in another material by another

Fig. 28.

set of tools." * For instance, we should not try to copy the appearance of a pen-drawing in a lino-cut; although the child's original idea may have appeared in a drawing or a painting, when he uses this idea again for his lino-cut he must express it in the terms of the new material. Linoleum is a soft material, lines cut upon it are of necessity coarse and even clumsy; this is due to the nature of the material. It would not be possible to obtain the fine details of a pen-and-ink drawing on a linoleum block. Fine white lines can be produced by engraving on a hard boxwood block (a material which is quite unsuitable for children), but here again the final result should bear the character of a wood engraving and not that of a pen-and-ink drawing. Children will soon grasp this idea if it is put clearly to them; they will understand why it is that the true craftsman never attempts to copy something, which may be legitimately done in paint, when he is working in stone. This understanding should help them to distinguish between the genuine and those imitations which surround us on every side.

We shall encourage the children to work directly with their tools with no previous tracing and very little drawing. In this way they will soon learn to accept the limitations of the medium they have chosen, and will not try to make their tools perform feats for which they were never intended.

Lino-cutting

Nearly every child enjoys lino-cutting. Linoleum is fairly easy to handle and, provided the tools used for cutting are sharp, most children in the Junior School will be able to make pictures in this way. It will be necessary for the teacher to have made one or two blocks for herself before she begins to teach the children. In this way she will have learnt enough of the craft to enable her to teach them how to use their tools and to help them to make good prints. Teachers who have never done any lino-cutting or printing will find this an easy way of making their own Christmas cards or printing designs for wrapping-paper, end-papers, or book jackets.

Lack of recent experience in drawing and picture-making generally should not deter us from beginning again. Very simple subjects or patterns, which require no previous training in draughtsmanship, should be attempted at first—a Christmas tree, house and garden, a boat, a jar of flowers and leaves (the simplest flower and leaf forms may be used), or a little block of simple pattern of the kind that has already been suggested in Chapter IV. When it has been cut, the latter may be printed as a repeat, half-dropped or in alternate squares (Fig. 28).

The following materials and tools are necessary:

Linoleum

This is now supplied by most artists' colourmen in stock sizes for use in schools. Any good-quality plain linoleum which has not a shiny surface and has not been polished may be bought by the square yard and cut up into convenient sizes. Sometimes off-cuts or traveller's samples of old stock may be procured; these are excellent for the purpose, as they are generally much thicker than the stock of today. Very

* Herbert Read in *Henry Moore, Sculptures and Drawings*.

thin and cheap linoleum is not suited for young children; it is difficult to handle and blunts the cutting tools because it is brittle and hard.

Tools and their Use

Sets of specially designed lino-cutting nibs which fit into wooden handles are now supplied for children by many firms (see Chapter XII). These cutting nibs have been evolved from the tools of the wood-carver and the wood-engraver. Most sets usually supply V-shaped gouges of different sizes; these are the most useful tools. They are employed like the graver to produce the broad or fine white lines of the design, and are used first (Fig. 29*a*). Besides these, there are gouges of different sections and sizes which are used for clearing away large areas of linoleum (Fig. 29*b*). These are specially useful for the method of colour-printing which is described later. There is also a knife-shaped nib which can be used instead of the small blade of a penknife (Fig. 29*c*). The wooden handles which are supplied with the cutting nibs are often rather large for small children to use. They may be cut down to a more suitable length.

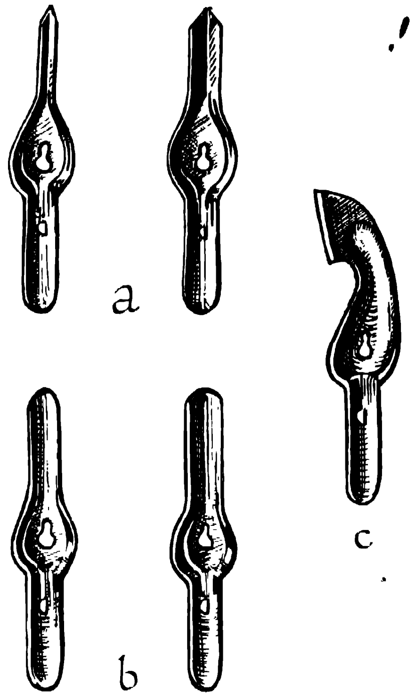


Fig 29.

When no specially made tools are available, it is possible to make a sort of gouge out of a sharpened umbrella spoke. This must be cut to a convenient length and inserted into a wooden handle or strong cork. All the cutting tools that are used, whether nibs or penknives, should be very sharp. A child cannot be expected to do good work with blunt tools; he will find them difficult to control. A bad slip with the tool may result in a cut hand or an irreparable mistake on the block. A hard Arkansas stone and a little sperm or typewriter oil should be kept for sharpening these small tools.

Before beginning to cut a block for the first time, both the teacher and the children should try using the different cutting tools on an odd scrap of linoleum. In order to find out how to control the tool, the children may first try to cut a simple pattern of zigzags or wavy lines and dots. In this way they will find out how to make the different kinds of strokes and curves; by experimenting with each tool in turn, they will discover the characteristically shaped cut that it will make. The child should sit down and cut at a desk or table; he should hold the tool firmly in one hand and steady the block with the other. In general, the wrist of the cutting hand should be held straight, the thumb or first finger resting on the block to guide

the tool. If the child is to draw as freely on the block as he would with a pencil on paper, he must learn to control the tool and to co-ordinate the movements of *both* hands. For instance, as he rounds a corner with his cutting tool, he should also be turning his block towards the tool with his other hand. It will be most necessary to warn him to keep the hand that is holding the block well *behind* the cutting tool in order to prevent him from cutting himself. The children are far less likely to do this if good pliant linoleum is used and the tools are really sharp. Blunt tools will always slip. It is wise to keep some simple first-aid dressing like Elastoplast and acriflavine jelly in the cupboard in case of accidents.

Children who have already made patterns by means of potato-cuts will understand the principle of relief printing, but even so they will understand the process of cutting and printing from the lino block most easily if they are shown both a block which has been cut and a print taken from it before they begin to make their own. We may take the opportunity to point out that only the broad essential features of a design may be expressed in this medium. Whatever subject the child may choose must be cut upon the block boldly and simply. Figures, houses, ships, or trees must all be thought of as simple shapes which will fill the block; the design must not be complicated by small, fussy details; these will be difficult to cut, and in the attempt to do so the characteristic clarity of a lino-cut will be lost.

When the child has had a little practice with the tools on an odd piece of linoleum, he is ready to begin to cut his own block. Provided he has a clear idea in his head of what he wants to do and that the subject he has chosen is one which can be simply expressed, he should be encouraged to draw straight away on to the block with the tool. If he has no clear idea of his subject, he should perhaps make a rough drawing which will fill the space of a piece of paper the same size as his block. If he uses charcoal for this sketch, he will not be able to draw unnecessary details. When he begins to cut his block, he may have this drawing beside him, but he should not try to copy it line for line; by cutting directly on to the block he will probably improve on the original drawing as he gains confidence in the use of the tool. The following suggestions will also be useful to the children: "Remember that once you have cut a piece of the block away it cannot be replaced. You can begin by cutting a white outline round your shapes (this is the way children nearly always begin). When you have completed your picture by filling the space in this way, we shall take a print from the block; then we can decide whether to cut away any more of the block or not. It is the sharp contrasts between the black and the white which make a linoleum print look attractive; these contrasts show up best when the edges are clean and sharp, so don't rock your tool from side to side to make it cut; this will make your lines have ragged, untidy edges. Don't be in too much of a hurry; it is better to begin by making short strokes which you can control, than by making long cuts which will slip and spoil your block. Very shallow cuts will not print well, very deep ones are not necessary. Keep your left hand well behind the tool all the time, or you will cut your-

self." Children should be discouraged from cutting right over the edge of the block, the white of the design will not tell if too much of it is allowed to connect with the white of the surrounding paper; on the other hand, a formal border or frame often spoils the continuity of the pattern; the black edge of the block is sufficient in itself.

Printing

The importance of learning how to make a good print from a block has already been stressed in the section on potato cutting in Chapter IV. There it was said, "Printing can be a satisfying occupation in itself; it is a part of the whole pattern-making process; neither cutting nor printing should be thought of separately." This is equally true of picture-making by means of lino-cuts. Children in the Junior School will need a good deal of individual help at first; they always enjoy printing, but patience and encouragement are needed for good results to be obtained. The first successful print of each block should, after trimming, be mounted and hung in the classroom; in this way the child will feel proud of his achievement.

Materials for Printing: Ink

When working with young children, it is advisable to use inks which can easily be cleaned off the tools. Ordinary printing ink is waterproof and oil-bound; it dries slowly and will not wash off children's hands or clothes; it can only be dissolved by paraffin or turpentine. On the other hand, *water* inks, which are now supplied by artists' colourmen, have the disadvantage of being more difficult to use than ordinary printing inks, though in other ways they are much less messy for children. Each teacher must decide for herself which kind of ink will be the most suitable for her purpose. Water inks are made in a number of different colours, including transparent white (for mixing with other colours to make them pale) and opaque white. It will be found that black is the most effective colour for general use. The stiffest water inks are the easiest to use; the sloppy variety should be avoided; they fill up the finer lines of the block and spoil the print (see Chapter XII). Water-colour inks are only suitable for printing on paper; they cannot be used for printing on washable fabrics, of course.

A piece of bevelled plate glass or a mirror is necessary for rolling out the ink evenly before inking the block. A smooth tile or slate may also be used or, if there is nothing else, a piece of thick paper or smooth cardboard pinned to a board could be used.

Roller

A roller for inking the blocks may be bought from any of the well-known artists' colourmen (see Chapter XII). The best-quality rollers are made of a gelatine composition. These will spread the ink more evenly, but they are expensive; the cheaper photographic roller which is made of hard rubber will stand more wear and tear and is probably the most convenient for children to use. Gelatine rollers have to be coated by the makers with special material if they are to be used with water-colour inks.

Paper

Almost any thin paper can be used for hand-printing. It is advisable to ex-

periment with the different kinds of paper that are available. Kitchen paper, thin unruled notepaper (air-mail), good-quality toilet or tissue papers, can all be used successfully. If thicker paper is used for hand-printing, it is often necessary to damp it. This is done by leaving the paper under pressure between sheets of well-damped blotting-paper for about an hour. Thicker paper, like cartridge or sugar paper, may be used if a printing press is available. A dessertspoon can be used as a burnisher for printing the impression.

Making a Print

All the materials for printing should be laid out neatly before beginning the process. The desks (two or three side by side) or table should be covered with newspaper. A little ink should be put on the glass slab and spread out evenly with the roller. It is essential that the ink should be spread evenly over the *roller* itself—it is therefore best to roll in one direction only, rather than to and fro. If there is too much ink on the slab, the roller will skid about, dragging the ink unevenly; it should grip the ink and make a characteristic pricking noise. Since children tend to use too much ink, it is important to see that the right amount is on the roller before the block is inked; too much ink will fill up the fine white lines in the block, and this will ruin the print. Surplus ink on the slab may be removed by running the roller over a piece of newspaper several times, re-inking the roller and repeating the process until the consistency of the ink is right. When the ink is ready for use, it is rolled over the block; the roller must be inked several times and rolled over the block in different directions to ensure that it is sufficiently inked all over.

In order to prevent ink from spreading all over the place and spoiling clean printing paper and other materials, the children should be taught to put the roller *up-side down when it is not in use.* This is essential when a good-quality gelatine composition roller is used; otherwise it will lose its shape. The printing paper is now placed on the inked block from the top edge downwards and pressed gently into place. Next the back of the print is rubbed all over with the handle of a dessertspoon or a burnisher; the movement should be circular. Very little pressure will be needed for printing on thin papers; in order to prevent holes being rubbed through the paper, it is wise to lay a piece of cartridge paper over the top of the print before using the burnisher; this is always necessary when the printing paper has been damped. Thicker papers need more pressure, they also slip easily and need to be held firmly in place while the printing is in process. Occasionally a corner of the print may be cautiously lifted to make sure that the paper is taking the ink well and that the pressure is sufficient. Young children should not be encouraged to do this, however, as they are most likely to move the whole print in the process. Sometimes the block is greasy and will not take the ink evenly the first time it is printed. This may be corrected by washing it with soap and water or rubbing it with a piece of raw potato.

After the first print has been made, older children will be able to cut more of the block away until the whites and blacks are balanced to their satisfaction. The block must be cleaned with a soft damp rag before recutting is

begun. If printers' oil-bound ink has been used, it can be wiped off fairly easily; it should not be cleaned with turpentine. India-rubber will help to remove ink from the finer lines on the block. In the first print there is generally too much black in proportion to the white. When the print is dry, the child can alter it with white chalk or paint; this print will then be a useful guide to him when he recuts the block. Some children are unable to leave well alone, they will go on cutting away at a block until they have spoiled it. If we see this happening, we may suggest that they should stop cutting and make some good prints instead; we may also remind them that a good artist always knows when to stop.

Lino-cutting and printing should only be attempted with small groups of children. If the class is a very large one, the children should take it in turns to do this or any other activity which involves special material and apparatus. It is quite possible to work with a group of ten children from 9 years and upwards; but young children under 9 need a good deal of individual help and supervision; here, then, a group of five or six children will be enough.

Colour Printing

The usual method of colour printing by means of separate blocks is a long process requiring sustained effort and a degree of accuracy which is far beyond children of Junior School age. However, a simpler method has been evolved which can be used successfully with quite young children, and by this means a limited number of colour prints may be made (Plate XXIV*a* and *b*). The block is first cut in the usual way, all the shapes being outlined with a white line; all those parts which are to remain white in the final print are also cut away before the first inking (for example, clouds, white garments, sheets, or flowers, etc.). The block is now ready for the first printing. For this it is often convenient to choose the palest colour or the one which will recur least often in the design. White ink, however, should be used last, as it is most effective when printed over another colour (see Plate XXIV*a*). Since this method of colour printing consists in cutting more of the block away each time a new colour is printed, it is necessary to make as many prints *at the first printing* as will finally be needed. The prints can never be repeated, because the original design on the block is destroyed as the printing proceeds. When a number of first prints have been made, the block is cleaned ready for the second cutting and printing. This time all the areas which are to remain colour No. 1 in the final print are cut away in order that no other colour will print over them; then the block is re-inked with colour No. 2 and printed again on top of the first prints that have already been made. These prints will now be in two colours plus white, and if the child is pleased with the result, they may be left in this state. A third colour, and even a fourth, can be added to the prints by repeating the cleaning, cutting-out, and re-printing processes. Each time, it is necessary to cut a piece of the block away to make the previous colour permanent before the block is re-inked and printed with the new colour. There is very little of the original block left when the printing is finished, but children do not seem to regret this, nor to want more prints than they originally

decided upon. Characteristically, they usually want to begin making a new block. Plate XXIV*a* was printed with oil-bound printers' inks on a small hand-press and made in the following way:

First printing—pink. The block was first cut, and then all the raised parts were printed in pink; then it was cleaned and the pink flowers, pink vase, and pink check on the table-cloth were all cut out.

Second printing—dark greyish-blue. This time all the background, the checks, and the small pieces on the flowers and vase were printed. After cleaning, the dark checks were cut away. Now the whole of the table-cloth had been cut out of the block.

Third and final printing—white. This was printed with the block slipped down and produced the dark shadows beneath the flowers (the dark edge of the second printing may be seen projecting at the top of the Plate). These shadows are most successful, for by distributing the darks more evenly throughout the design they add greatly to the charm of the print. This is a piece of skilful manipulation which, though extremely effective in this instance, should not be used too often.

Cut and Torn Paper, Appliqué, and Collage

From time to time both teacher and children will enjoy a change of medium. Cut and torn paper and appliqué may be used for picture-making as alternatives to drawing and painting. Nearly all children love cutting out, arranging and sticking coloured papers and other materials. Besides providing another practical means of restoring the confidence of timid children, it will be found that the materials themselves stimulate new ideas and will often have a tonic effect upon the whole class.

The approach to each of these activities is similar. No drawing or tracing should be done on the material. The tools (fingers or scissors) are used directly to tear or cut it; in this way the finished picture will show the character of the material from which it has been made. In each case, too, the method is similar: the materials are first cut or torn, and then stuck. It is necessary to help the children to choose the kind of subjects which may easily be expressed in terms of the material. For instance, cut paper is a useful medium for pictures of towns, villages, railways, and docks; its sharp, well-defined edges may be used to suggest the structure and angularity of buildings. Walls or railings, cranes, trains, tanks, and ships are specially suitable objects for pictures that are made in this way, while animals, trees, flowers, and the sharp, crisp shoots of leaves and grasses may also be used with success if they are treated decoratively. Torn paper, on the other hand, with its soft, irregular edges overlapping or merging into one another, evokes the more imaginative subjects from the child's world of fantasy; it is altogether a more creative and sympathetic medium. The hard, relentless qualities of cut paper enable the child to give a limited factual description of what he sees, but by using torn paper he is more able to express what he *feels* about the subject he has chosen. The actual manipulation of the material develops his sense of touch and increases his sensibility to surface textures; this awareness in turn will be a valuable asset to him as a painter. For this reason, it is useful to combine torn or cut paper-work with

paint to form the kind of picture known as collage.

Additional experience in the handling and arrangement of varied materials may also be obtained by means of appliqué. Here, the child's natural sense of colour and pattern, together with his growing feeling for the different textures of the materials he is using, will combine to produce the liveliest pictures or decorations. It must be emphasized that appliqué is used in this connection *solely as a means of picture-making* and not as an adjunct to needlework. If the child is to learn to think of his picture as a whole, that is, to concentrate upon the relationship of shape and colour rather than upon the treatment of inessential details, he must not be distracted by methods of stitchcraft. How he fastens his materials to the background is of little importance at this stage; the ultimate success of the picture will always depend upon the design and upon the child's spontaneous approach to it. Again, if appliqué is to be used to build up the confidence of those children who find drawing and painting difficult, undue insistence upon technical accomplishment will not be likely to further this end.

Almost any of the subjects that children generally like to do are suitable for the "sewn" picture: houses, trees, ships, gardens or landscapes with animals or people. By reason of the ease with which figures may be clothed in fancy dresses made with snippets of silk, satin, striped cotton, velvet, or felt and decorated with braid, net, wool, or ribbon, appliqué provides children with an excellent opportunity for making pictures of people and may be used in this way to overcome their distrust of figure-drawing. "A Fairy," "An Indian Brave," "A Smart Lady," or "A Highwayman" are all subjects which will give the child an opportunity for inventing clothes. This he will enjoy doing almost as much as dressing-up himself; both girls and boys take the greatest interest in this kind of work.

Before each of these activities is described in detail, the following general suggestions, which apply to all of them, may be observed:

(1) When children are working with these materials for the first time, they should begin by working all together in easy stages: it is often advisable to set a subject for the whole class to use. In this way some of the initial difficulties are easily overcome, and soon each child will be able to follow up his own ideas independently with only occasional help or suggestion from the teacher.

(2) When the main portions of the picture have been either cut or torn, these should be arranged on the background before they are stuck down. Some children will instinctively make a satisfactory pattern very rapidly, others will need more time; they should all be encouraged to juggle about with their pieces, arranging and rearranging them, since the final success of each picture will depend on its pattern as a whole. Each child should submit his picture to the teacher for approval before he begins to stick the pieces into place. For her part, she should be prepared to accept his arrangement.

(3) For all cut or torn paper-work it will be found more satisfactory to use a strong paste than to use ready-gummed paper; these papers are made in limited ranges of bright, but often crude, colours which do not go well together. In any case, children often

PLATE XXV

(*a*) RABBIT (Girl 9 years) Size 12 in. × 5 in.

(*b*) RABBIT IN HUTCH (Boy 7 years) Size 10 in. × 8 in.

(*c*) HORSES (Girl 5 years) Size 8 in. × 7½ in.

(*d*) PONY AND TRAP (Girl 6 years) Size 15 in. × 10 in.

PLATE XXVI

(*a*) THE COW WITH THE CRUMPLED HORN Cut-paper decoration Size 22 in. × 15 in.
See reference on p. 254 and Plate XXIII (*a*)

(*b*) OUR VILLAGE Cut-paper frieze Co-operative work Size of entire frieze 5 ft. 5 in. × 2 ft. 6 in.
See reference on p. 255

PLATE XXVII

(*a*) MANDARIN   Torn-paper   (Boy 11½ years)
Size 15 in. × 11 in.

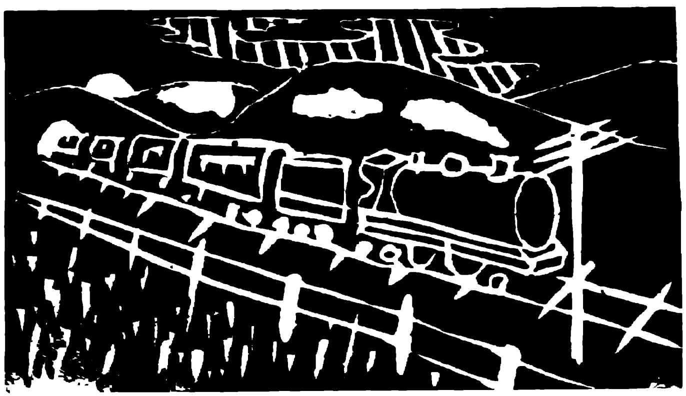
(*b*) BUCCANEER   Torn-paper   (Girl 10 years)
Size 11 in. × 7¼ in.

See reference on p. 267

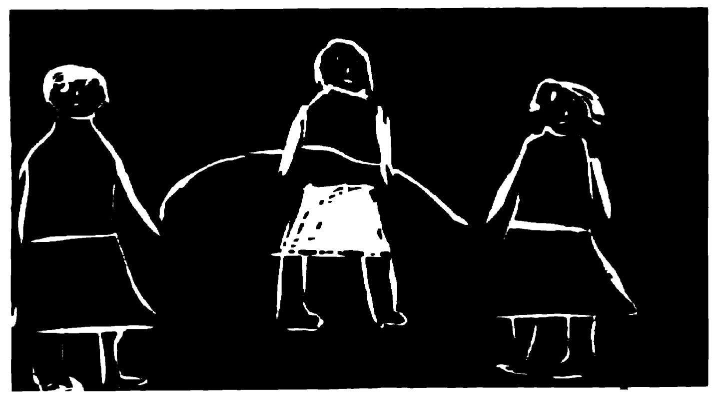
PLATE XXVIII

(*a*) MAN AND DOG Appliqué (Boy 8 years)
Size $8\frac{1}{2}$ in. × $8\frac{1}{4}$ in.

(*b*) WOMAN WITH A WASHING LINE Appliqué
(Boy 7 years) Size $9\frac{1}{2}$ in. × $7\frac{1}{2}$ in.



(*c*) A TRAIN Lino-cut (Boy 10 years) Size 5 in. × $3\frac{1}{2}$ in



(*d*) SKIPPING IN OUR STREET Lino-cut
(Girl 9 years) Size 6 in. × $4\frac{1}{4}$ in.

Both these prints were made by cutting directly on the block with the tool.

succeed in licking off all the gum before the paper has a chance to stick. A little paste in an old saucer or tin lid may be shared between two children; only old or cheap brushes should be used for applying it.

(4) At the end of a lesson each child should put his own scraps of cut or torn paper or cloth into an envelope which has his name on it, otherwise much of his work will be lost or destroyed before the next lesson. The children can decorate papers with their own patterns and make these envelopes for themselves.

Although torn paper is a more interesting medium than cut paper, many children find it difficult to manage until they are 10 or 11 years old. In spite of this, however, it is a good plan to begin paper-work by tearing rather than cutting, particularly with children of 6 or 7. Their efforts will probably appear to be crude and untidy. This is inevitable with such young children, and is of no consequence. If they begin by cutting the paper, they tend to concentrate on little niggly details at the expense of broad essentials of the design. The characteristic uncertainty of torn paper makes it necessary for the child to visualize the basic shape of the object he is making—a man, or horse, or tree, for example, before he begins. This is an excellent training for him, and we shall follow it up by helping him to arrange these shapes in relation to one another and by teaching him to think of his picture as a whole.

Materials for Cut or Torn Paper-work

For these activities it is necessary to have a collection of papers of varying texture, colour, and quality which is kept specially for this purpose. The children will be able to provide a large part of the collection. The following suggestions will be useful:

Children's discarded paintings and patterns, papers that have been decorated by comb and paste painting, graining or marbling, old posters, decorated pages of *Radio Times*, newspaper, well-designed book jackets, wall-paper, Christmas and trade wrapping papers, watered paper, and wood-grained paper. The above should all be torn up into irregular shapes before the children use them. Used crackers, Christmas decorations, or paper hats, coloured crape papers, coloured tissue papers, chocolate and sweet papers, paper d'oyleys, silver and gold cigarette papers, coloured, plain, or patterned cellophane, bookbinding papers, corrugated chocolate papers, paper wool.

Suggestions for Torn Paper-work

A lesson in torn paper with the 7-year-olds might be given in stages as follows: each child should be provided with a piece of grey sugar paper or black or coloured pastel paper, about 10 inches by 12 inches. The paper which is to be used for tearing may be divided up into five or six piles; each pile should contain a variety of papers. Then the children may be divided into groups and allotted a pile of papers from which to make their choice. We shall begin by describing the subject of the picture: "Today you are all going to make a picture of a scarecrow" (some general discussion on the habits and appearance of scarecrows should follow this announcement; children who live in towns may never have seen one, and will need a detailed description). "Now that we are ready to begin," we may continue,

"choose from your own paper pile a colour that you think will do for the scarecrow's face—any colour will do for a Tattibogle; he could have a green face or a brown, or a yellow one if you like. At the same time choose a piece of paper for his hat; it may be a top-hat, a felt, or a straw hat. Now we shall begin by making the face and the hat. The face must be at least as big as this (a circle of 1½-inch diameter). The hat may be a very battered-looking one, because people only give their oldest hats away to scarecrows—perhaps it will have a hole in it." When all the children have torn a face or a hat and placed these on the paper, we may go on: "Next we shall choose a piece of paper for his very tattered coat. You can choose any that you like and make it a long coat or a short one. The wind will have blown all sorts of holes in it. Later on we may be able to stick some patches on to these, to keep the poor scarecrow warm. You can tear out the body and arms all in one piece, or you may find it easier to tear the body of the coat first, then each arm separately." The lesson will continue in this way, the children working together a stage at a time. When the scarecrow, with his sticks, scarf, buttons, and face, is complete and has been arranged on the paper, he may be pasted down. Children are always inclined to use so much paste that it oozes all over the paper. They should be warned of this and told to put it on thinly.

This picture may be completed in many different ways: a strip of ragged paper may be pasted at the bottom to represent the broken ground, or several thin strips may be arranged as furrows; a cloud, a tree, or birds may also be added.

Cut Paper-work

When the children have grasped the importance of filling the space with significant shapes, they may safely be allowed to begin cut paper-work. The younger children will enjoy this more; they like the sharp outlines and rapid results that may be obtained with scissors. Here, again, the main part of the picture should be completed before any embellishments are added, otherwise the original conception may be lost in a maze of irrelevant detail.

No attempt at naturalistic representation should be made in cut paper. Like embroidery or tapestry, it is essentially a decorative medium; the subject should be treated two-dimensionally as a pattern of formal shapes. Young children do not find it easy to cut very small things; they should be allowed to cut at whatever size may seem to be convenient, regardless of the scale. For example—just as a forest may be suggested by three trees and a few tufts of grass, a tree form may be fully expressed by a trunk and three large leaves. Like the artist, the child often enlarges those things which seem to him to be important in his picture without considering their true relation in space (see Plate XV). In a two-dimensional picture this is particularly appropriate.

Let us suppose that Little Red Riding-hood has been chosen as a subject. The children should first cut out a large figure of Red Riding-hood, then Grandmama's cottage, a few trees, and the wolf may be added. These should all be suitably arranged and stuck down. When they are doing a figure, children sometimes cut out a body-shape first and then put the clothes on it. This is a waste of time, of course. They

should begin with the head, then cut out the dress or coat, and complete the figure in this way: in this instance the cloak and hood will be stuck down last, on top of the other clothes, and the hair.

Now the picture is ready for decorating. A few of the following suggestions for this and other pictures will help the children to think of things for themselves. For houses—smoke from the chimney, curtains in the windows, people looking out, flowers in pots. For people—feathers, belts, bows, boots, buckles, buttons, garters, swords, epaulettes, decorations, and sashes. For the landscape—grass, ferns and flowers, butterflies, clouds, birds, branches, leaves, and fruits. (See Plate XXVI*a*.)

A variety of attractive patterns and shapes can be made by folding and cutting paper in different ways; a few suggestions will help the children to discover ways and means for themselves. Sometimes flower or star-like shapes may be invented and used for background patterns, or the finished picture may be decorated by border patterns made of folded and cut paper, where this seems suitable.

Teachers will get some useful and interesting suggestions for cut-paper work in *Coloured Paper Craft for Infant Schools* and *Coloured Paper Craft for Schools*, both by Frederick T. Day, published by Newnes Educational Publishing Co. Ltd.

Collage

When the children are older (10 and 11) they can profitably return to torn paper-work and combine this with paint in an exciting way. They will have much more manipulative skill by then, and will be more able to appreciate the peculiar virtues of paper-tearing and the possibilities of collage. Children use patterned papers in a most original and imaginative way; it is well worth while collecting a wide range of different papers for them to choose from. The portrait reproduced on Plate XXVII*b*) shows how papers have been used to suggest the character of the subject. By the skilful combination of pieces of sugar paper, combed pattern, and a patterned strip from a child's painting, a bold colourful Buccaneer has been created. This material offers both the teacher and the children ample scope for the expression of purely imaginative subjects or abstract patterns. The irregular shapes of the paper itself stimulate fantasy and often suggest an idea for a picture; there is no end to the variety of subjects that may be treated in this way. Every encouragement should be given to the children to experiment with different textures and colours and to explore the possibilities of contrast and juxtaposition.

Powder paint may be used in conjunction with torn paper to enhance the effects of a picture and to provide a contrast in texture and treatment. For instance, supposing the subject of a picture is the inside of a cottage living-room, the chairs, table, fireplace, and curtains may all be made from torn paper, but the view through the window, the pattern of the wall-paper, and the ornaments may be painted. A "Harbour" is a good subject. Here, the houses, jetty, lighthouse, and boats may be made out of paper and combined with a painted sea and sky. A "Shipwreck" provides another opportunity for collage. The broken ship with its pale, tattered sails and splintered masts, ashore on the dangerous

rocks, may be torn out of paper, while a combination of paint and paper will be used for making the stormy sea and sky. The nearer waves may be made of paper, with their white crests painted, the clouds may be made by tearing irregular shapes of sugar paper or strips of silver paper and arranging them on a painted background; finally, the shrouds and tangled rigging may be drawn in pen and ink.

Children of 10 and 11 will soon understand that with a picture of this kind it is necessary to make the background first, to arrange the objects in the middle distance next, and those in the foreground last; they will learn to think of the picture in these three simple planes rather as if it were a stage set. This may sometimes help the older child towards thinking in three dimensions instead of two as he has done in the past.

Suggestions for Appliqué Work

The construction of the sewn picture is very much the same as the cut-paper picture or collage. As before, we shall teach the child to think of his pattern as a whole and to compose the essential forms within it boldly. Again, the richness of effect will depend to a great extent upon the variety of texture in the materials that are used. If the child is given a wide range of colours to choose from, his natural sense of colour and pattern will show to advantage in this medium.

In addition to the list of materials which may be found among the suggestions in Chapter VIII, the following will also be useful for sewing, binding, and outlining the shapes: coloured braids, rick-rack, gimp, carpet binding, bias binding, tape (pink, black, and white), and fancy tapes, cords, and horse braids of various colours (the latter may be purchased from a saddler), embroidery silks, wools, and cottons. A great deal of the work may be done with large embroidery needles which can be easily threaded by children, though smaller needles will be necessary for some of the details. The foundation for an appliqué may be made from some inexpensive material such as hessian (coloured or plain), coarse canvas, or unbleached calico. When only small groups of children are doing the work, it may be possible to supply them with frames upon which the material may be stretched, but these are not really necessary, as children seem to manage quite well without.

The main portions of the picture should be stuck down before being stitched. Little children will find tacking rather tedious, but a dry paste will help to keep the pieces of material flat until they are ready to be sewn down.

It will be wise to tell older children to allow for turnings when they are cutting out; that is, to cut their shapes a little larger, otherwise the final arrangement will be much smaller than was originally intended. They will soon see that a shape looks larger if it is stitched round the edge with its own colour, and smaller if the colour of the background is used: often the stitching may be done in vivid contrasting colours which will give the work a lively quality.

Children of 7 and 8 should be allowed to use the simplest stitches and to solve their problems in their own way as far as they are able. They will often begin by sewing the material down with a running stitch, or by turning the edges in and hemming them down. (Plate XXIV*c*.) The younger children will be

quite satisfied with the results gained in this way. In any case, they will be more interested in making a new picture than in learning embroidery stitches. These can be learned later when the child's interests move in this direction; they should not be taught at the expense of creative spontaneity. Among the older children, however, we shall find some who are ready to learn a few easy stitches and who will enjoy using them. For these children the following stitches may be recommended, both for sewing down the materials, defining the outlines, and for decoration: button-hole or blanket stitch, chain stitch, herring-bone stitch, simple couching, oversewing, and French knots. Of these blanket stitch is probably the most useful.

Here are some ways in which the materials that have been mentioned may be used. Various kinds of fancy braid of different sizes may be used by older children for "drawing" animals, trees, or fences. Furniture gimp may be used in much the same way for making the furrows on a field, or the ruts in a road. Paths and roads can also be made with carpet binding or similar material. Braid which is frayed out will make the smoke of a chimney or a steamer, two or three parallel rows of rickrack may be used to suggest the waves of the sea. Tiles on a roof, brickwork, or the bark of a tree may be suggested by darning stitches. Clouds and rain may be made from netting; hats, topboots, and belts out of felt; buttons and beads may be used for the heads of flowers or as decorations on clothes; thin metal milk-bottle tops may also be cut into star or flower-like shapes and applied in the same way. Thick darning wool will make good hair and moustaches, and older children will enjoy using white cotton to define the features in a face. The children will only need a few suggestions of this kind to help them to begin exploring ways and means on their own account. Picture-making should be an adventure for them, an opportunity for invention and discovery.

CHAPTER TWELVE

MATERIALS

IN these days, when goods of all kinds are in short supply, it is sometimes difficult to provide suitable painting materials. It is absolutely essential, however, that children should be given the opportunity to paint frequently, since no other activity has the special educative value of painting. Chalks or pastels will not do instead of paint. Occasionally they will be useful for filling in an odd ten minutes at the end of a lesson, or again, they may be successfully used in conjunction with paints or inks, but in general chalks should not be used as a substitute for paint. The names of several well-established artists' colourmen are given below in alphabetical order. All of these are able to supply paper, brushes, and paints which are suitable for use in schools:

J. Bryce Smith Ltd. (Educational).
Dryad Handicrafts.
George Rowney & Co. Ltd. (Educational).
Winsor & Newton Ltd. (Scholastic).

Paper

Paper is supplied by artists' colourmen in standard sizes; these vary slightly, but they are approximately as follows:

Royal	25 x 20 inches.
	24 x 19 inches.
Imperial	30 x 22 inches.
	29 x 21 inches.

Double Crown, 30 x 20 inches.
Double Elephant, 40 x 27 inches.
Continuous cartridge, 30 inches wide in rolls of 12 yards or more.

Two kinds of paper are generally supplied for use in schools: a blue or grey sugar paper (royal) and a thin paper (double crown or imperial).

The sugar paper is fairly thick and absorbent. Paint must be used thickly and opaquely upon this paper. The thin papers that are supplied are like kitchen paper or drawer-lining paper, or unprinted news-sheet. They are generally white, in which case the paint may be used opaquely or transparently. The best of these papers have a certain toughness; the worst feel more like a tissue paper and should be avoided. Many kinds of paper which are not strictly art papers may be used for painting: sulphite paper or baker's wrapping or cap papers. These inexpensive papers are often very similar to the advertised art papers; they may be obtained from paper merchants, a number of whose names will be found in the classified trades directory. The quality of paper is expressed in weight per ream. For example, the cheapest sugar paper is about 35 lb. to the ream, the better quality about 70 lb. If good-quality cartridge is required, paper of 50 or 60 lb. should be purchased.

Paper is measured as follows:

24 sheets = 1 quire.
20 quires = 1 ream.
480 sheets = 1 ream.

It is important that children should be given paper which is a good shape for picture-making. Royal is a good size and proportion, but if it is halved, the long, narrow shape, 20 × 12½ inches, is unsuitable for ordinary picture-making, though it may be used for a frieze to illustrate a continuous story like the Bayeux tapestry, for example. Continuous cartridge paper is also most useful for larger friezes. Half-imperial (22 × 15 inches) is a very fair proportion, though double crown (20 × 15 inches) is better. Half-imperial paper may have an inch or two taken off the long side with advantage; similarly, 13 × 10 inches is a better proportion for small pictures than 15 × 10 inches. The odd strip of paper may be used for testing colours while the painting is in progress; afterwards it can be cut off. Children who find it difficult to begin painting when they are faced with a blank rectangle of paper are sometimes encouraged by working on an odd, irregular shape which can be mounted after the picture is completed. The irregular shape is less alarming than the formal rectangle, and often helps to stimulate the imagination.

When it is possible to buy a variety of paper of different colours and textures, a stock of pastel and other papers may be purchased.

All quietly coloured papers are good to work on; children often prefer a toned paper to dead white. Fawn, smoky blue, biscuit, or dull green are all pleasant. Occasionally an individual child or a group of children may be given a special sheet of pale-yellow, blue, or pink paper as a treat. Bright, strong colours should be avoided, though almost every child will enjoy drawing with white chalk or white paint on black paper from time to time.

Paints

Powder paints are generally found to be the best for children. Besides these, a few water-colour boxes may be kept in the store cupboard for the use of individual children who enjoy using transparent colour on a small scale. These paints should be of good quality; cheap water-colours are quite useless, the results are always disappointing, while the child's difficulties are greatly increased. Winsor & Newton's "Scholastic" colour boxes and Rowney's "Students" are recommended.

The artist keeps a wide range of pigments in his box. From these he selects a few for his palette, varying his range for each picture. This is the ideal way to stock paints for the art room. A large number of different colours should be stored to enable each child to make his own choice of three or four different colours (excluding white). The Ostwald series of eight standard colours and four neutrals are often included in lists of powder paints. Though some of the colours in this series are extremely useful (these are marked Standard O below), the range as a whole is not perfect. In some respects it could well be augmented, while a few of the colours are not absolutely necessary. For general use the following colours are recommended. Those in italics represent the minimum requirements of any painting class:

White A quantity of white is necessary; every child should be supplied with some.

Reds: Vermilion, Crimson Lake, Light Red.

Yellows: Chrome or Standard O Yellow, Lemon Yellow, *Yellow Ochre*, Raw Sienna, Raw Umber.

Blues: Cobalt or Standard O Blue, Standard O Turquoise, Prussian Blue.

Greens: Viridian or Standard O Sea-green, Emerald Green.

Black: Full Black.

The following colours may also be used in addition to those above, but they should be kept separately and used sparingly under the teacher's direction. They are all strong, penetrating colours and must be used with discretion: Ultramarine, Standard O Leaf-green, Standard O Purple, Indian Red, and Burnt Sienna.

Some colours are used up more quickly than others; it is necessary to requisition four pots of white paint, two of red, and two of yellow, to one pot of any other colour.

It is essential that the red which is chosen should be a bright pillar-box vermilion; crimson may be used as well, but it should never be substituted for vermilion. This is the red which children love to use and from which a good orange may be made. In addition to the powder colour, poster paints, in pots or tubes, and coloured inks will be useful for special occasions. A brilliant range of colours may be obtained in these inks from either Winsor & Newton, Reeves, or Rowney.

Various kinds of pastels are suitable for schools. Winsor & Newton's Superchrome crayons and Reeves' Terrachromes are cleaner to handle and more durable than the ordinary pastels.

The Dryad Handicrafts Fineart crayons may also be recommended. Rowney's school pastels may be obtained in half-lengths which break less than the full size. Many of these pastels are also supplied in the Ostwald Colour Series, which in this case is useful.

Brushes

Enough brushes should be stocked for every child in the largest class to have at least one. These should be mainly long-handled hog or Chinese horsehair; sizes 5 and 6 are suitable for half-imperial or royal paper; a few smaller brushes, sizes 2 and 3, should be bought; also some larger ones, sizes 7 to 10. Hog-hair brushes are usually rounded in shape. When the main stock has been bought, brushes of other shapes with square, flat tips, for example, may be added as funds permit. A number of camel-hair or fitch brushes may also be provided, and a few special sables with fine points (size 4 or 5). These should be kept separately and given out to children for special work.

Young children sometimes find the long-handled brushes rather difficult to manage; the handles may be cut a little for them. In the Nursery and Infant Schools the short-handled stiff stencil brushes which are supplied in various sizes will be found useful.

Tins

Powder paint is most conveniently handled in bun tins. These can be bought with six, nine, or twelve separate sections; the latter should be cut in half to make two six-sectioned tins. The six-sectioned tins are the easiest to store; the plain variety are the best; scalloped or ribbed tins are difficult to clean. Separate patty pans or tin lids will do instead of bun tins, though these are easily upset unless they are nailed on to a narrow, short length of board. Old saucers or deep scallop shells may also be used when bun tins are not available.

Water-pots

These should have a good wide base and a wide mouth; 1-lb. jam jars or old breakfast cups are good. Potted-meat jars, which hold very little water and are easily knocked over, are of no use.

Drawing and Other Materials

The pencils which are supplied by schools for daily use are not much good for drawing; they are hard and unsympathetic. Carpenters' pencils, black chalks, *b* or *2b* pencils, and charcoal are all good. The store cupboard should also contain the following things: Pens with nibs that are easy to draw with; mapping pens, drawing-pins, scissors, pencil sharpeners, an oilstone, a bottle of turpentine or paraffin, if oil-bound printing ink is used, some clean rag, blotting-paper cut into small pieces, a quantity of rough paper for mixing paint on, a box of first-aid finger dressings, linoleum-cutting tools, blocks and inks, gum.

Printing Inks for Use with Linoleum

Excellent water-colour printing inks in twenty colours, including transparent white for mixing with other colours, or opaque white for printing, may be obtained from T. N. Lawrence & Son. Oil-bound printing inks in black and many other colours are also supplied by T. N. Lawrence and by L. Cornelissen & Son. Assorted lino-cutting tools and handles may be purchased from the above firms or from the other well-known artists' colourmen. An oilstone can be obtained from T. N. Lawrence. Rubber and gelatine rollers are supplied by T. N. Lawrence and L. Cornelissen. Rubber rollers can also be bought from photographers' suppliers.

Easels

Folding easels hinged back to back, at which the children can work, are supplied by J. Bryce Smith Ltd. A small number of these are most useful; they are easily stored in a spare corner of the room. As an alternative, sloping boards may be fixed to the wall. These are hinged to a batten and fold down when they are not in use.

The Care and Storage of Materials

It has been said that a proper respect for tools and materials is the first step towards good craftsmanship. Artists' materials will last twice as long if they are properly cared for. While children should not be allowed to misuse tools or materials, a miserly attitude on the part of the teacher will spoil the spontaneity of their work and prevent them from making their own experiments. The wise teacher will aim at providing the children with the most suitable materials (not necessarily the most expensive) and will maintain a balance between extravagance and parsimony. The following suggestions for the care and storage of materials will be useful: Paper should be kept flat and not in rolls. For this purpose an architect's plan chest is ideal for storing both clean paper and the children's work. Time and labour will be saved if the work of each class is kept in separate drawers. The best alternative to the plan chest is a set of shelves wide enough to take imperial-size paper, with about eight inches between each shelf. These can be constructed with boards or with battens surfaced with cardboard. Trestle table-tops may also be used, and these should be supported on boxes to keep them off the floor. The upper shelves

can be separated from each other by square-cut blocks of wood arranged at each corner.

The children's work should be kept flat in cardboard or paper folios, which must be clearly labelled with the name of each class and kept in the appropriate drawer. In this way the teacher will be able to find the work of any individual child easily; responsible children can fetch their own work, help themselves to clean paper, or give it out to the rest of the class. Paper which is kept in open shelves should be covered over during the holidays to keep it clean.

It is often advisable for the teacher to put powder paint out into the bun tins ready for the younger children to use. Older children may be allowed to help themselves, and for this purpose it is advisable to have some cheap kitchen teaspoons (one for each colour), to avoid mess and waste. Children tend to fill the tins too full; the paints get dirty and clogged before they are used up, and finally they have to be thrown away. Only a small quantity (about half the bun tin) of each colour should be put out at a time; when this has been used up, fresh paint can be put into the section. It is far more economical to put out less paint and to keep the colours clean.

Bun tins will last well if they are varnished or painted white before they are used. Unless this is done, the sections sometimes rust right through and fall out; the whole tin must then be replaced. At the end of each term, tins should be washed clean and repainted. If there is a large quantity of tins, it is better to wash and paint half a dozen at a time when it seems necessary, rather than to have a great many to clean up at the end of the term; it is often difficult to find enough room to dry the tins, and this is a slow process during the winter months. A child who has finished his own work a little before the end of the lesson will enjoy helping with this work. Powder paint which has dried into a hard cake can often be used again if the colour is clean; it should be softened with a little water some time before it is used. This difficulty may be avoided to a great extent if the paint is kept dry in the bun tins. *The children should never be allowed to pour or drip water into the tins.* The quality of the paint is ruined in this way. The dry powder colour should be taken from the bun tin by means of a *damp* brush only, it may then be mixed on palettes or on rough paper. Saucers, tin lids, or shells that are used as palettes for mixing should be well dried after they have been washed, otherwise any colour that is mixed upon them will be thin and runny. As gum is one of the ingredients of powder paint, bun tins and containers should not be stored near a radiator or in a cupboard with hot pipes running through it. This also applies to tin boxes or bins which are used for storing clay.

Bun tins should be stacked in piles of about six or eight, arranged in opposite directions across each other. Large piles of tins are easily upset; if they are not arranged alternately, each tin will get messy underneath from contact with the tin below; subsequently paint will be spread all over the desks. Poster paints in pots or tubes should have their screw-caps replaced as soon as the lesson is over. These paints are useless once they have been allowed to dry. For the same reason it is most important to see that printing inks or coloured drawing

inks are all covered immediately after use.

Brushes must be well washed after each lesson. The handles and metal-work should be kept clean, as well as the bristles. A good shake will help to dry the brushes before they are put away, either lying down on a tray or standing on their handles in a large crock or jar. Special sable and other expensive brushes may be dried and put away in boxes, provided that these are long enough to hold them comfortably. No brush should ever be left standing on its bristles; its shape and natural springiness will be ruined beyond repair. Brushes have an extraordinary way of disappearing. They should be counted at the end of every lesson before the children leave the room.

Little children often enjoy washing out the water-pots, but they do not always do this very thoroughly. It is important to see that the bottoms of the jars are kept perfectly clean. Fresh water that is put into dirty jars will soon become muddy. Clear, brilliant colours can only be obtained by using clean water; every child should be able to begin painting with clean water in a clean jar, and they should be allowed to change their water during the lesson when this is necessary.

All the drawing materials, pens, chalks, pencils, charcoal, drawing-pins, rulers, and special tools such as linoleum cutters, rollers, inking-slab, etc., should be kept in separate boxes. These should be clearly labelled in block capitals in order to help individual children to find their own tools and to put them away again when this is desirable. Each pair of scissors should either be nicked with a file or have a piece of coloured braid sewn on to it, to show that it is the property of the school. Drawing-boards should be numbered and have the name of the school painted across them.

Listed below are the names and addresses of those firms who supply the materials which have been recommended:

For Painting and Drawing Materials

Winsor & Newton Ltd., Wealdstone, Harrow, Middlesex.

J. Bryce Smith Ltd., 117, Hampstead Road, N.W.1.

Dryad Handicrafts, St. Nicholas Street, Leicester, and 22, Bloomsbury Street, W.C.1.

Reeves & Sons Ltd., Aswin Street, E.8.

George Rowney & Co. Ltd., 10 & 11, Percy Street, London, W.1.

For Printing Inks and Materials

L. Cornelissen & Son, 22, Great Queen Street, W.C.2.

T. N. Lawrence & Son, 4–7, Red Lion Court, Fleet Street, E.C.4.

For Fancy Papers

F. G. Kettle, 23, New Oxford Street, W.C.1.

CHAPTER THIRTEEN

CONCLUSION

IN Chapter I, it will be remembered, the changes which have taken place in the methods of teaching art were outlined, while the need for a new and more co-operative relationship between pupil and teacher was stressed. But we shall sometimes find that although imaginative subjects have taken the place of the old attempts to copy cubes and other objects accurately, the atmosphere in the classroom itself has changed very little.

It is always possible to give children hard and unresponsive materials with which they cannot make a mess, and to enforce a silence in which we may be able to hear a pin drop. However, we shall not expect to find happy, natural children making good pictures in these artificial and restrictive conditions. At the other extreme, we may allow the children to have an unlimited amount of individual freedom with access to quantities of expensive materials and expect them all to produce pictures that are fit for public exhibition.

Neither of these approaches leads to the most fruitful kind of activity. Of the two, the first can be positively harmful, since it prevents the child from being active at all. If his personality is cramped by the tight discipline of the old school and his means of expression are very limited, he will not be able to grow as he should, and his dull, lifeless pictures will reflect this state of affairs.

The second approach needs a closer examination. Here, at least, the child is not tied hand and foot by discipline that is imposed upon him by an all-powerful teacher. The danger is, however, that this freedom will be abused. It is from these casual, haphazard conditions that the so-called "New Art" has sprung. "New Art" can be quite as undiscriminating, and in its own way academic, as art teaching in the early part of the century. According to its canons, the child must always use large paper, work with large brushes and standardized powder paint; he is never expected to work with delicacy or precision. He is not encouraged to look at the world around him as a source of inspiration for his pictures, but is expected to work "out of his head" without replenishing the storehouse of his mind. The truth about perspective must be kept from him for as long as possible.

It is true that he may derive some enjoyment from slopping quantities of paint about, but this kind of activity is akin to the play of infants; it will not bring with it the deep satisfaction of the artist who is learning to master his craft in order to communicate his thoughts and feelings. Nor will this kind of painting give him the mental activity which is necessary for his satisfactory growth; in addition, with no guidance and absolute freedom of choice, he may well feel insecure and

at a loss. If the child is to feel self-confident and free to work in his own way, he needs the comfortable security of an ordered background, together with the certainty that his teacher will always take his work seriously. There is all the difference between giving a child's work serious consideration and lavishing praise with undiscriminating sentimentality on everything he produces. The child comes to his art class as to the dinner-table, full of hungry anticipation. He needs to be settled down at once with suitable implements, just as he is settled with his knife and fork at table. We shall see that his paper is cut ready for him to begin work upon it at once, and that his water-pot is in a safe place where it cannot easily be upset all over his work. Whenever it is possible, we shall arrange for him to be able to help himself to all the materials that he needs; we shall teach him to care for his tools and see that he attends to his share of the clearing-up at the end of a lesson.

When the teaching period is only forty minutes, we shall need to plan the beginning of the lesson so that each child can begin work on his picture within the first ten minutes, especially when there are twenty to fifty children in the class. From the preceding chapters we have seen that art lessons need as careful preparation as any other lessons. We shall always have a few specially chosen subjects ready for those children who need them. Since a settled atmosphere cannot be achieved until all the children are busy, it is important that no time should be lost during the first few minutes in vague administration.

While the children are at work, different ways of using their materials will suggest themselves. We shall share these discoveries with them, encouraging them to experiment with different combinations of media, for example—paste and paint, collage, pen and ink, pastel and paint, transparent water-colour and ink, etc., and to explore these possibilities for themselves.

It is by *watching* the children both at work and play that we shall learn most about them; the more we know about children and care for them, the better teachers we shall make. As we watch them painting and discover the natural artist in each child, we shall learn to respect their judgment. We shall realize their sensitivity to textures, gift for pattern-making, and eye for colour, and the rightness of their instinct in these matters. Whenever we are in doubt, we shall leave the child alone, letting him work out his picture in his own way. Too much teaching will probably do more harm than too little.

Our aim should be, therefore, to send from the Primary School children whose confidence has not been undermined and whose æsthetic sensibilities are alive and vigorous.

As Herbert Read has said: "The *rapport* established between the teacher and the child is the all-important factor. The growth of confidence, the elimination of fear, the binding force of love and tenderness, these are the elements with which a teacher must work."

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WEAVING AND SPINNING ACTIVITIES

CHAPTER ONE

SIMPLE WAYS OF WEAVING AND PLAITING: PRIMITIVE LOOMS

The Value of Weaving in the Primary School

WE quote again (see Volume II, HISTORY) from the Ministry of Education's pamphlet on Art Education. It says of the Junior School: "Now is the time to let boys and girls explore some of the paths travelled by primitive men and women—to experience through experiment the early stages of the traditional crafts, such as pottery, weaving, basketry, the making of simple forms of dwelling, or of means of transport."

Professor Dewey says: "Intelligent children interested in their history lessons, interested in the way in which men lived long ago, the tools they had to do with, the new inventions they made, the transformations of life that arose from the power and leisure thus gained, are eager to repeat like processes in their own actions, to remake utensils, to reproduce processes, to rehandle materials."

In schools where there are free activity periods, the children have opportunities to do these things. It is essential that children should have worth-while occupations from which they can choose, and weaving is such an occupation. It must be strongly emphasized that free periods should only be free for *all worth-while* occupations.

In the Primary School there must be no suggestion that children are being taught a craft so that they may become weavers. Weaving is only a means—one of many—of satisfying certain tendencies, of developing certain qualities, intellectual and moral, of making better individuals who can understand more easily the world around them.

When presented in its simplest and most primitive form, weaving—one of the industries most essential to the welfare of man—awakens an enthusiastic interest and ready response even in children of Infant School age. A great sense of wonder is shown by them when they discover that so many useful and beautiful articles about them are made up of an infinite number of small threads woven together. If they are taught how to make some of these articles in miniature, they are filled with a sense of joy and satisfaction.

Weaving, moreover, is bound up with

pattern or design. Certainly it should help to develop an appreciation of pleasing design, if only in well-arranged stripes, good proportion, and good workmanship (see Chapter V).

It is among the oldest of crafts, older than pottery, for the first clay pots were made with the help of baskets. It is intimately bound up with nature and the first homes. It is instinctive with the "animal" world, for we have the intricate weaving of the nests of birds, the spinning of threads by the silkworm and spider.

Among human beings the first weaving was undoubtedly done with pliant branches of trees, reeds, rushes, and coarse grass, and the first things woven were shelters and walls of houses (see HISTORY, Charts I and VII), cradles, mats, baskets, boats, etc. Spinning came later.

THE FIRST WEAVING FOR CHILDREN 6 TO 8 YEARS

The first weaving the children do should be with loose strips. Almost every child likes to weave if he is given a chance; for his muscles want exercise, his infant interests are largely interests in activity. The weaving principle is very simple. If you show it once, almost any child will understand it; yet it will have a double value if you let him discover it for himself. Interest in weaving begins in several ways. Children who hear about the first shelters will want to find thin, pliant branches and make the windbreak shown in Chart I, HISTORY. They will probably want to make a shelter in the garden for themselves. In connection with stories of the Ancient Britons, they are almost sure to want to make huts with wattle-and-daub walls, and try to make woven or wattle coracles (see Chart VII, HISTORY). The desire to learn to weave also arises in connection with projects on home life, or when the doll's-house or play-house is the centre of interest. Indeed, one of the best problems for a group of children, because it admits of work of different kinds, is the making and furnishing of a doll's-house. Furnishing a doll's-house will show the children how important a place weaving occupies in home-making.

WEAVING WITH LOOSE STRIPS, THE EARLIEST FORM OF WEAVING

For the younger children, especially if they have had no experience of weaving in the Infant School, manageable material should be provided such as strips of stiff paper, stout cloth, or felt. A fairly new material called Strip Linson (also used for book-binding) is useful. It can be obtained in continuous lengths of varying widths. It is washable and tougher than paper, so that it can be used for making useful mats, table-covering, or floor mats. The 1-inch-wide strips, and $\frac{1}{2}$-inch-wide strips, are best for the early work. The warp threads may be used loose or pinned on to a blackboard or a board of some kind. The weaving strips should be of a different colour. When the weaving is finished, the ends of the weft strips are pasted to the warp, or the mat is bordered on both sides by a 1-inch or 2-inch strip.

The majority of six- and seven-year-old children quickly learn to thread under one, over one, and to reverse the process in alternate rows, but there are always some children who find this apparently simple process surprisingly difficult. It sometimes helps backward children if a larger floor mat is started

at which two or three can work in their free periods, the teacher sometimes helping with a line. Incidentally, it may be mentioned here that children good at arithmetic are often good at weaving; or to put it in another way, weaving helps arithmetic. Number seems to be inherent in weaving. Practical ideas of number are gathered quite naturally, for no pattern can be constructed without dividing and analysing the warp threads on a loom. Odd and even numbers come to have distinct meanings. Often they mean nothing to a child. That there must be an odd number of warp threads makes children think about odd numbers. Apart from the actual weaving, measurement is needed or involved in dressing dolls and in planning rugs and carpets for the doll's-house.

Children will get plenty of practice in weaving in connection with their doll's-house. When making small articles there is no need to pin the warp strips in place. In fact, it often makes the work more difficult. If necessary, the first weft strip can be pasted in place. With strips of white and brown paper children weave floor covering for the dolls' kitchen. They want brighter and better material for the dining-room or sitting-room.

An easy and convenient way of making mats that forms an introduction to the loom is to give the children squares of paper (7-inch square). The square is

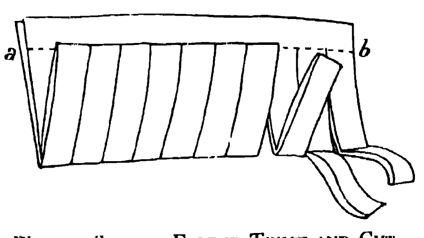

Fig. 1.—Square, Folded Twice and Cut.

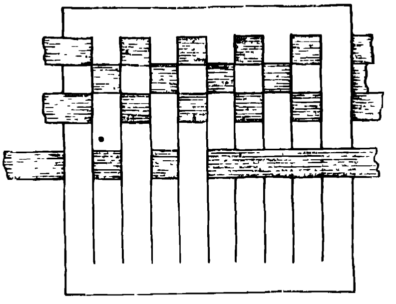

Fig. 2.—Square, Opened and Woven.

folded into half and a line *a–b* drawn along the open edges, 1 inch from the ends, as in Fig. 1. Fold again up to *a–b*, and make cuts up to *a–b*, 1 inch apart, as in Fig. 1. Unfold and weave with loose strips, as in Fig. 2. Children, at least intelligent children, soon learn to cut their own mats. When the children have had some practice, finer work can be done with cuts half an inch apart.

At first the children are so keen on weaving that they do not think much about the pattern they are weaving. They are content with a warp of one colour and a weft of another. Soon they see patterns can be made by changing the colour of the weft, or going over two and under one. Indeed, there is no end to the patterns that can be thought out, especially by older children (see Chapter V). These paper looms are valuable for planning patterns in different weaves or different colours. Children begin to realize that beautiful effects can be obtained as one colour hides behind another, and then comes out again apparently brighter than before. They can copy some of the colours they see in Nature—flowers among green foliage. Paper weaving is not a waste of time if it has purpose behind it. Children in the upper classes

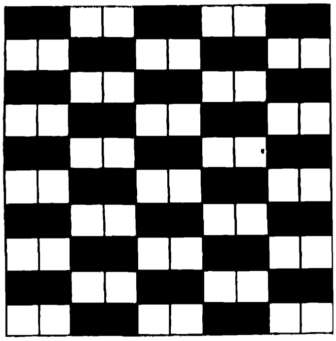

Fig. 3—First Simple Pattern.

often think out lovely colour schemes. They notice which colours placed side by side make each other very bright—orange and blue, red and green, yellow and purple; which colours soften or tone each other down—blue and green, etc. Fig. 3 shows the first simple pattern a child may think out, just over two and under two, instead of one. Fig. 4 shows a pattern that needs thought.

Finding Nature Material for Weaving

It is of great educational value to let children make excursions to the country to look for material to weave. They bring home grasses of different kinds, and if possible reeds and rushes because of their flat, broad surface. Some grasses are easy to weave when they are green; when dried first, they curl up and break. Children enjoy experimenting with their finds. This applies especially to country children. In the early summer, excursions should be planned for the gathering of rushes and long grasses. With these the children try to make simple baskets, mats, cradles such as the people long ago may have made. Useful baskets can also be made for gathering fruits. The basket described here is a favourite with country children.

Rush Basket (Figs. 5 and 6).—It is wise to dry slowly in the shade the rushes and grasses to be used for weaving, turning them frequently. Baskets from new green rushes, though pretty and useful for perhaps a day, dry quickly, shrink, lose their shape, and tend to fall to pieces. To make the basket shown in Fig. 5, lay the rushes parallel to one another. Take a piece of bast or raffia, fold it in half, put it round the middle of one of the outer rushes, cross the two ends, put these under and over the second rush, cross again, and catch round the third rush. Repeat until a line has been woven across the width of the basket, as in Fig. 6. Put in two other lines, one on each side of the middle line, and a little distance away, as in Fig. 5. The cross weaving holds each rush firmly in place. Gather up the rushes at each end of the basket and tie them firmly together, as in Fig. 5. This weave that holds the rushes together is known as "pairing." The children will meet it again in basketry. Instead of the simple handle shown in Fig. 5, a plaited grass or raffia handle can be made (see coming section).

Bundles of straw or grasses can be

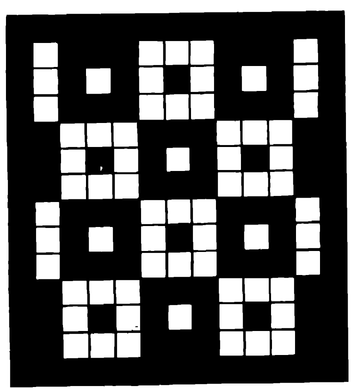

Fig. 4—A Pattern that needs more Thought.

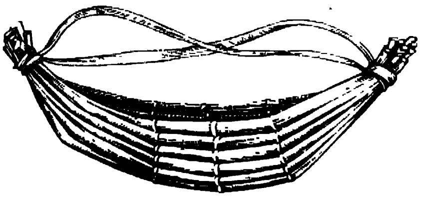

Fig 5.—A Rush Basket.

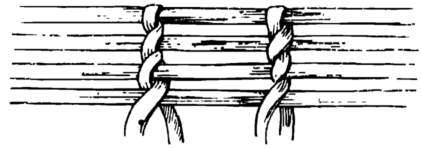

Fig. 6.—Detail of Weaving Rush Basket.

fastened together in this way to make mats for use in the garden. These were probably the first mats used in caves and huts thousands of years ago.

Children like to make door-mats for the doll's-house, mats for the table for hot dishes, etc., from pieces of thick cord or string all cut the same length. Raffia, coloured string, or macramé cord, is woven in between, as for the rush baskets. Children enjoy making these mats when they know they will be useful. It is often the sense of worth that gives earnestness to their work. On the other hand, children enjoy making many things for the joy of making only, and not for their ultimate use.

The manipulation of the weaving thread is difficult for some of the younger children, but eight-year-olds can manage it quite well. Apart from other reasons, this form of handwork is useful for making fingers nimble. A child with clumsy fingers is very handicapped in after years. The children also use the grasses they pick, and raffia, for plaiting.

Plaiting (Figs. 7, 8, 9) is one of the early forms of weaving with loose strips. Its many uses in everyday life give natural opportunities for its introduction. The children may want reins, a new whip-lash, a strong handle for a bag or basket, when a single strand of raffia is found of no use, a new hat for a doll, etc. Hair, too, may need plaiting.

Making a Three-ply Plait of Raffia (Fig. 7).—Single strands of raffia make too fine a plait, and put undue strain on the muscles of the hand, especially of the younger children. The first plaits should be quite coarse, using three or four strands of raffia to form one set in a three-ply plait. It is easier for the children, and of greater interest, if the three sets of strands are of three different colours; for example, brown, green, and natural. Nine or twelve strands are tied firmly together, and then fastened to the desk or to the back of a chair in order that the plait may be pulled somewhat tightly as it is being woven. Unless the end is secured in some way, it is impossible to get an even plait. This the children often discover for themselves. Another way is to knot the strands together and put each through a hole in a piece of cardboard, as in Fig. 8. This cardboard is then fixed to the back of the desk. This prevents the different sets of raffia strands from getting entangled.

To replace a thin or used-up strand, take a new one, lay it beside the old, *when it becomes the centre strand*, and use the two together, as in Fig. 7. After a few plaitings, the new strand will be firmly caught and the end E is cut off. When the plait is finished, the ends are sewn together and the knots cut off. The younger children who find it difficult to join new raffia strands on when plaiting may first plait short lengths;

Fig. 7.—Three-ply Plait, showing new Strand E being inserted.

these can be sewn together to make table-mats, or mats for the doll's-house. The ends of the plaits are tied tightly and frayed out to make a fringe.

When they can plait long lengths, they can make hats, round mats, or baskets. To make a hat, they hold the end of the raffia plait and bend the plait around the smallest possible circle, sewing it in place on the under side; then they sew the plaits edge to edge until a round mat, or the top of the crown of a hat, has been formed. Children find little difficulty in shaping hats for their dolls. Indeed, when they start off to make a round mat it generally becomes shaped like a bowl and is easily converted into a hat! Children much enjoy bringing their dolls to be fitted with the newest shapes.

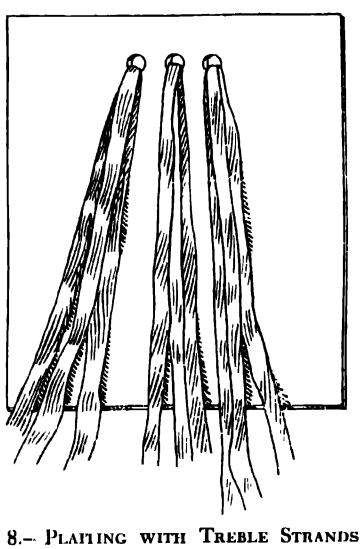

Fig 8.—Plaiting with Treble Strands of Raffia.

The three-ply plait is most suitable for general purposes; a plait of more than three is too difficult for children under eight.

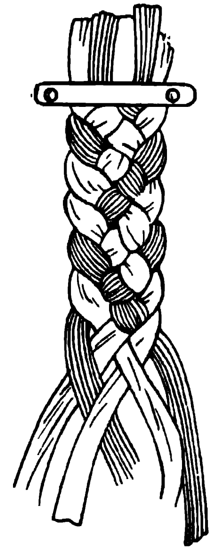

Fig. 9.—A Five-ply Plait.

A Five Plait (Fig. 9).—This is only suitable for children over eight. Plaits of five and over, that is all broad plaits or braids, are begun by holding them in a vice made of two pieces of wood nailed together, the raffia, rushes, or braid being placed between. The vice can also be made of two pieces of cardboard fastened by paper-fasteners. The vice is hung on a wall or some convenient place. In all plaiting or braiding it is better to stand up to the work. To plait, separate the strands into two groups, taking two in one hand and three in the other. Take the outside strand in the three group and weave to the centre, thus making three on the opposite side. Now take the outside strand on this side, which has become the three group, and weave to the centre. Repeat this process, always weaving with the outside strand of the group having the *larger number*, and weave to the centre. To weave with nine, separate the strands into two groups, taking four in one hand and five

in the other, and so on. Broad plaits are best finished off by threading each strand on a needle and weaving it back on itself. The plaits can be used to make belts, or sewn together to make bags, purses, glove-cases, etc. If made of wool, they may be used to ornament and finish woven garments. Children will think of a variety of ways of using broad plaits.

PRIMITIVE LOOMS (Figs. 10, 11, 12)

Children soon find that while it is easy to interlace pliant branches, or stiff material, or weave raffia in and out of sticks stuck in Plasticine to make a fence, it is much harder to weave with loose grasses, raffia, or soft material, because the warp slips about. The larger the thing made, the more difficult it is to weave with loose strips. Some means are needed to stretch the warp threads if raffia or wool is used. One of the earliest methods was to tie the warp strands to a low-hanging branch of a tree, and to weight each strand by tying a stone at the end. Children will look with added interest at Penelope's loom on History Chart V and the ancient British loom, History Chart VII. *Loom weights* (pieces of clay or lead) have been among the relics found during excavations in Greece. They are said to belong to the fifth century B.C. Children themselves will probably suggest tying the warp threads round something, such as a ruler or stick.

Fig. 10 shows the result of the children's experiments in making a first loom. It is made from two pieces of firewood or two small branches of a tree. They soon saw this loom was not rigid enough. It was difficult to weave in the weft, and the warp threads were not straight and would come close together.

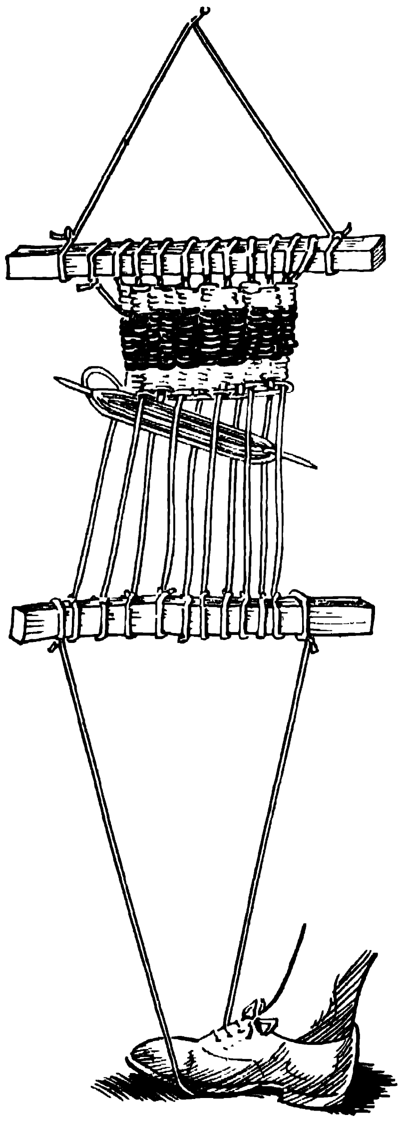

FIG. 10.—PRIMITIVE LOOM: THE FOOT KEEPS THE LOOM STEADY.

To keep the loom rigid, a loop of string was fastened to the top bar and hung on a nail, as in Fig. 10; another loop of string was attached to the lower bar, long enough for a child to put his foot in and keep the loom rigid when he was standing up and weaving. Illustrated

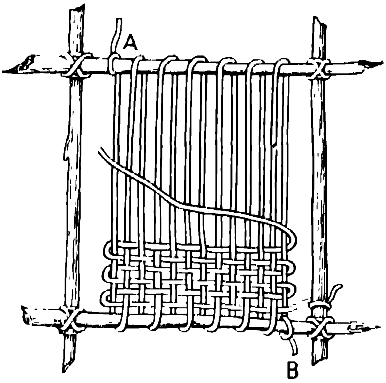

FIG. 11.—LOOM MADE FROM FOUR BRANCHES.

is a primitive loom often thought out by children themselves. Four sticks are fastened securely to make a rough square or oblong, as in Fig. 11. String or raffia or some coarse material is used for the warp. To thread the loom, tie the warp thread to stick A as shown, and wind it not too tightly round the horizontal sticks A and B until the loom is strung. Tie the end of the warp to stick B. Use raffia for the weft. It helps children at first if the weft is tied to the right-hand warp thread or to one of the upright sticks, as in Fig. 11. When a new weft is required, it need not be knotted to the old, but may be woven with the old for a short distance. After a few rows, any ends may be cut off.

Children make frame-looms like this for different purposes. Some do not take the web off the loom, because they are making a door or shield to go in front of a cave-dwelling they have modelled. Some who use pliant branches bend the two short sides so as to form a cradle to hang from or rest in the branches of the tree. These children had learnt that long ago women may have woven cradles something like this and hung them on a tree to keep them safe from wild animals. The old rhyme of "Rock-a-bye, Baby, on the tree top" may come to their minds. Others, again, use their weaving to make a kind of sledge or carrier on which hunters carried home their spoil or children their nuts and fruits in the days before wheels.

To take the finished work off the loom is more of a problem. The sticks that form the frame can be untied and the loops slipped off if the sticks are smooth. If some warp threads are left empty at the top and bottom, the loops can be cut at the top of the sticks, and the ends will be long enough to tie together. The ends of the knots may be frayed out to form a fringe. The children should be free to experiment; free to make things of only temporary value Indeed, what may well be called the "temporary arts" must play a large part in the Junior School, especially in the free activity periods.

Pretty raffia mats may be made from a loom similar to that shown in Fig. 11 if strips of wood or stiff card about ½-inch wide, or 1-inch wide, are used for the framework. The loom is strung as before. The colour of the weft should be a contrast to the warp. When the loops are cut along A and B, the ends are longer, and therefore more easily tied; the fringe also is longer. Use a pin to fray out and fringe the raffia ends. If desired, the weft threads may be taken around the vertical sticks. This will mean a fringe on every side.

A Raffia Cushion for the Garden (Fig. 12).—Saw four strips of lath the size required for the loom. (It may be possible to obtain window-laths from a builder; failing wood, cardboard strips must be used.) Fasten them firmly at the corners A, B, C, D (Fig. 12). If a

"real" cushion is being woven, the size of the loom should be at least 12 inches by 12 inches. Now tie some strands of raffia across for the warp. Each strand should be at least four inches longer than the loom, as shown in Fig. 12. Use a single knot for the tie, taking care that an equal length of raffia is left on both sides to form a fringe. The raffia used for the weft must be in strands of the same length as those used for the warp. Use one piece for each time across, and leave equal lengths at each end for the fringe, as in Fig. 12. When the weaving is finished, untie the warp threads from the laths and take the square off the loom. Now weave another square in the same way. To fasten the two squares together, tie each raffia end of one square to the raffia end of the other all the way round. Leave the fourth side open until the cushion is stuffed with odds and ends of raffia or any soft material. Then tie up the fourth side. See that the raffia ends are all the same length, and fray them out.

In their experiments with frame-looms the children find the warp threads tend to get mixed up. They cannot keep them apart, especially if many warp threads are used or wool is used. To keep the warp threads straight, children may suggest cutting notches in the crossbeams. This is a good idea, but often too difficult for the younger children to carry out. Other thoughtful children are sure to suggest that nails or pins should be driven in along two sides so that the finished web can be slipped off easily. Boys like to try this, but the nails tend to split the wood, and without practice it is difficult to hammer a nail in straight.

Through their experiments the children will get familiar with many interesting and pleasing words—*loom, warp, weft* or *woof, web* (the finished work), etc. Children should be encouraged to make booklets for all the words they learn in connection with weaving. It is essential in the Primary School that every teacher helps with reading, spelling, and writing. To quite a surprising number of children, the written or printed word means more than the spoken, and what they *see* they remember better than what they *hear*. Children enjoy writing new words. As much of the above work will be carried on in the free activity periods, varied work can be done and individual children helped. They can be encouraged to talk about their weaving so that the teacher can make sure they really understand new words. Let them pick out the warp and weft threads on the pictures of old looms shown on Charts V and VII, HISTORY. As the children progress in weaving, so, in a sense, they progress in language. To many children, weaving gives an added interest in birds and birds' nests. Stories of the weaving birds, the oriole, and especially the African weaver, are a pleasure to intelligent children. It is said that two birds work together, one

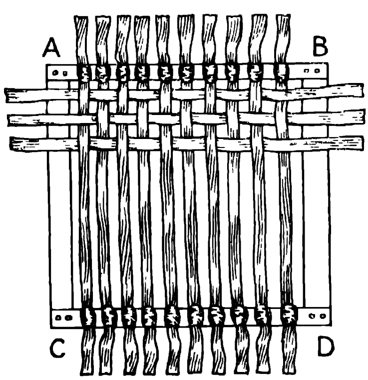

FIG. 12.—MAKING A RAFFIA CUSHION.

on the inside of the nest and the other on the outside, passing the grass and twigs in and out, until the home is completed. The children enjoy, too, stories of weaving in other lands. Then there are classical stories to be told such as Minerva and Arachne, Penelope and her loom, and anecdotes such as Robert Bruce and the Spider, etc. Some simple songs, stories, and games will be found in *Weaving and Other Pleasant Occupations* (Harrap). If any teacher is so old-fashioned as to remember the art, there is great joy to young children in knitting wool on four pins and a reel, the work, a long tubular cord, being afterwards made into reins or sewed into mats or small carpets. One must remember that work of a soothing nature —certain forms of apparently mechanical work—is very beneficial to some children. There is always the danger of over-stimulation, especially in the case of the highly strung child. The burden of planning and thinking out everything for himself must be relieved by sober routine work. The adjusting of occupations to children's needs, and the value of varied occupations, are discussed in the section on "Free Activities." A delightful "mechanical exercise," but embodying a well-known weave used in basketry, is the making of a Jacob's Ladder or Pussy-cat Stair, as it is sometimes called. Cut two strips of paper about 20 inches by 1 inch. Strips of two different colours please children most. Place the end of one strip over the end of another at right angles, and paste. Now fold the perpendicular strip *up* over the horizontal one, keeping them at right angles. Then fold the horizontal strip across over the perpendicular one; now fold down the perpendicular strip; then fold across again, and so on. Take care that each fold is absolutely even. Then pull out, and behold the stairs! Little fingers will work patiently a long time to achieve this charming result, and much skill of hand will be gained in the doing. The "stairs" can be used for Christmas decorations, making snakes. concertinas, etc.

CHAPTER TWO

SIMPLE CARD-LOOMS

CARD-LOOMS offer many possibilities to the children, and the things to be made must be controlled to a great extent by their needs or desires. The advantage of card-looms is that they can be made almost any shape, and therefore a great variety of things can be woven on them besides mats, bags, cosies, slippers, etc. Waste cardboard of all sorts can be used for looms; for example, the lids, sides, or bottoms of cardboard boxes, but the cardboard must be stiff enough not to bend under the warp threads.

The weaving for the first year, for the six-, seven-, and eight-year-olds, should be rapid. If they must work many days before they see the end, they weary. So at first coarse materials should be used and a loose mesh. Cotton or woollen rags, cut or torn to a width of $\frac{1}{2}$ inch, can be used, also raffia, soft jute, cord, etc. String often makes a good warp. Wool comes later, when it is a great joy to the children.

What will they make with their new looms? Whatever it is, it must be something the child wants to make and really believes to be useful, but the teacher must help those with no ideas! As a rule, a child wants to make something he can use himself or take home for his mother to use, and—this is most important—he should see the thing he has made used.

In making cardboard looms, as in the looms described in the last chapter, it must be, *as far as possible,* the child who plans, modifies, re-invents, improves, until he attains his end; in other words, the child must think. For the guidance of teachers, directions are given for making a few simple articles. The teacher must know how to make them, to realize the difficulties and be able to help the children. Children left too much alone tend to get disheartened and give up. It is an important part of the teacher's work to help children to accomplish what *they set out to do.* To encourage children to persevere in the face of difficulties is to give valuable moral training. Children often think making a cardboard loom, and cutting the notches to hold the warp, is easy, but they are bound to need help. Fig. 13 shows the simplest cardboard loom.

A duster or rubber for polishing the desks at school (Figs. 13, 14). This is perhaps the simplest thing that can be made on a card-loom. For the loom, cut a piece of cardboard about 9 inches by 7 inches. Half an inch from the short ends draw lines AB and CD. Divide each of these lines into half-inch spaces. Cut a notch at each division, as in Fig. 13. See that there are an *uneven* number of notches. For the warp, sew roughly, end to end, several strips of material such as art muslin or cheese-cloth, or some similar light material. Any odd lengths of soft material can be used. The strips should be about $\frac{3}{4}$-inch wide. To thread the warp, put one end

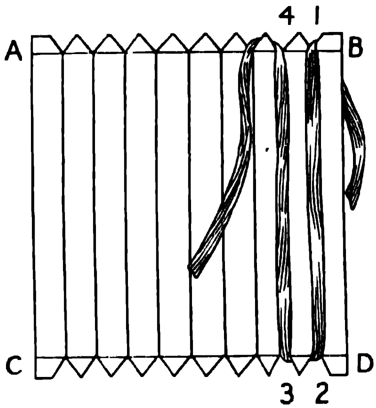

Fig. 13.—Loom for Duster

through notch 1 (Fig. 13), leaving a piece long enough to tie at the back of the loom. Pass into notch 2 and behind the point into notch 3. Pass up to notch 4, then behind to notch 5. Continue until the last notch is reached, then tie the two ends at the back of the loom. The appearance of the warp at the back is shown in Fig. 14. The weft should be made of strips of material sewn together as for the warp, but the weft should be a different colour to the warp. This makes the weaving more interesting, and it is easy to see mistakes. Draw

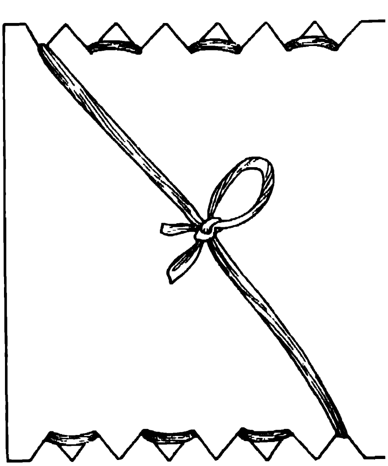

Fig. 14.—Back of Loom for Duster.

the children's attention to the *uneven* number of warp threads. To remove the fabric from the loom, untie the two ends of the warp, slightly bend the cardboard, and lift the loops from the notches. The ends can either be run into the material or sewn down.

Rug for a Doll's-house, weaving with four-ply wool. Children are pleased to make rugs, perhaps hearth-rugs, of wool for their doll's-house, or a woollen coverlet for their doll's pram in winter. Before making the loom, let each child decide on the size she wants and cut a paper pattern. The loom should be somewhat larger than the pattern. If the material for weaving is to be wool, the warp threads must be closer together than in the previous loom. Lines AB and CD are drawn a quarter of an inch from the short ends. Divide these lines into spaces of $\frac{1}{4}$ inch. If there are fourteen spaces, there will be thirteen marks or dots on each line. Cut notches down to these points, as in Fig. 15. The loom is threaded as already described for the duster. The ends of the weft can be finished off by being woven into the material. It is best to tie the beginning and end of the warp thread to a notch. This will keep the threads steadier.

By now the children need something to help them to weave besides their fingers, and thus follows the invention of the "shuttle." Hairpins, bodkins, cardboard or wooden strips with holes pierced through for an eye are tried. Fig. 16 shows one of the children's inventions. It is made of cardboard, has a sharp point and sloping sides so that it is less likely to catch in the wool. After some experiments, children can be introduced to weaving needles, raffia needles, etc., although some children often like to go on using their own inventions.

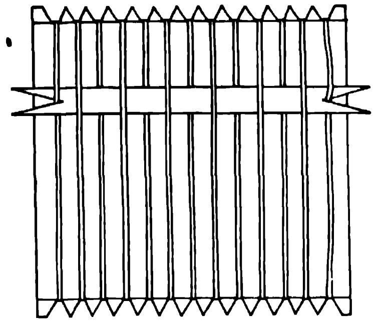

Fig. 15.—Device for keeping the Selvedge straight.

One of the earliest difficulties in weaving is the keeping of a straight selvedge. It is almost impossible for the beginner to avoid pulling in the warp threads and thus narrowing the material. The children sometimes have good suggestions for keeping the selvedge straight. One is shown in Fig. 15. A strip of cardboard notched at each end holds the outer warp threads in place and also acts as a batten. A batten is used to press back the weft and make the fabric stronger and thicker. As the children weave, the teacher will notice how the looms are turned round every time it is the turn of the left hand to send back the needle. To make the work easier, place a ruler under this set of threads and raise it edgeways each time the needle is passed from the left. This forms what is technically known as a "shed," and is the first step towards the planning of more elaborate devices for raising certain sets of threads. The children enjoy using the "shed stick." Leash rods and the development of the heddle (a device for raising and lowering alternate warp threads, and so making two sheds, one for "going" and one for "returning") must be left for later consideration (see Chapter IV).

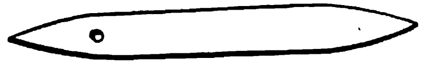

Fig. 16.—Cardboard "Shuttle."

Doll's Hood (Fig. 17).—Children are very keen on making doll's clothes. A doll's hood is easy. A loom similar to the loom for a rug is used, size about 6 inches by 4 inches. By stringing this loom in a different way, a doll's seamless hood may be woven. For all this early work coarse wool or four-ply wool should be used. Fine wool makes the work longer and is less suited for little fingers. *To string the loom*: the warp is tied to the bottom left-hand corner near the notch marked 1 in Fig. 17. Pass the thread up into 2, then down *behind* the loom into 1 again. Pass across the front to 3 and behind and up to 4, then down the front to 3 again. Pass behind into 5 and repeat as from the beginning. *The weft*: begin at A (Fig. 11). Tie the weft to the first

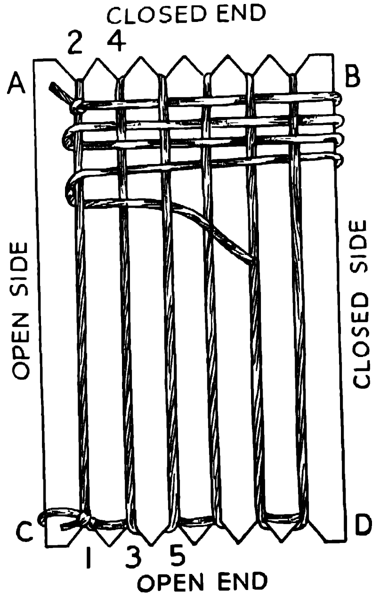

Fig. 17.—Loom for Doll's Hood

warp thread or leave an end to be woven in afterwards. Weave under and over. When the edge BD is reached, turn the loom over and go on weaving on the other side to the strand in notches 1, 2; pass the weft around this strand, and weave back to BD. Turn the loom over and weave to the first strand again, pass around it and back again, and so on. The side AC is thus left open to form the front of the hood; the side BD is covered or closed by carrying the weft around it each time. The top AB is closed because the weft threads are carried over the top each time. To remove the hood from the loom, take off the loops from the points on CD. The bottom of the hood will be found to be open.

When weaving with wool, knots should only be used in exceptional cases. New weft threads are introduced by weaving them side by side with the old. The ends of the weft or warp, when the weaving is finished, are threaded on a needle and stitched into the weaving. Never *cut* the ends of wool, as they will stand up and show. If the wool is *broken,* the ends lie perfectly flat and mat with the other wool.

In Fig. 17 the warp threads are drawn far apart to show the details of weaving. When the children find out how to leave open ends and closed ends on their looms, they think of many things to weave. A great variety of bags are sure to be woven.

Small Bag.—Cut the cardboard rather larger than the bag required; for example, 6½ inches by 5 inches. Prepare by drawing lines ¼ inch from the shorter sides. Divide these into ¼-inch spaces. The warp may be of thin string or raffia. Thread the warp as for the hood (see Fig. 17). The side with the loops will give the opening of the bag. Raffia may be used for the weft. Weave *continuously* round the loom, thus making a seamless bag with one open end CD, as in Fig. 17. Bags may be woven in coarse knitting cotton; the material chosen will depend on the purpose for which the bag is made.

Children will realize by now that there must be an *odd number* of warp threads for weaving. Where weaving is done on both sides, as for the bag, the second row of weaving will not alternate with the first, so that at one side of the bag the weft must always be carried over *two* warp threads. It shows little when the bag is taken from the loom; another way of making the necessary odd number is by stringing a double warp thread through one of the notches.

Reins (Fig. 18).—For this loom cut cardboard 11 inches by 3½ inches. Draw lines AB, CD as before, ¼ inch from each of the long sides. Divide these lines into ¼-inch spaces. Use four-ply wool. Thread the warp as for the rug. For the weft, cut nine pieces of wool 33 inches long. Put *three* together and weave under and over the warp. Take another three together and weave these alternately. The third set of three will be woven like the first. Pull the strands so that 11 inches hang over at either end of the loom. Plait the three sets together at each side. This plait is to form part of the loop

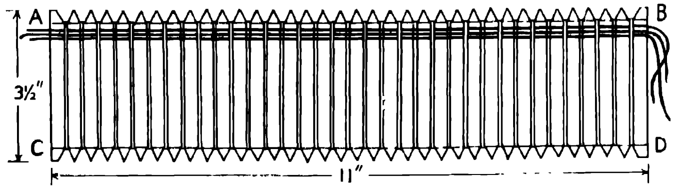

Fig. 18.—Loom for Reins.

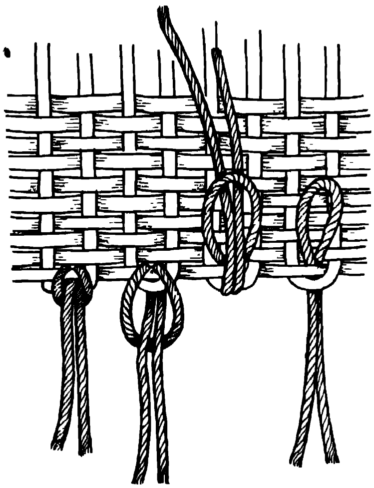

Fig. 19.—Fringe for Rug.

through which the arms are put. Another set of nine threads is woven in similar groups of three along the side CD of the looms (Fig. 18). To fill up the middle part, use single weaving in the ordinary way, or thread the needle with a double thread. The double thread makes variation in the weaving, and the work is finished more quickly. Fasten the two plaits on each side into a loop; bind over the join with wool to make it strong. The loops are for the arms to go through. Another way is to fasten the plaits into a small brass ring. Bind the ring round with wool. To these rings attach plaited reins. Sew bells along the centre of the band.

Other suggestions for articles that can be woven on simple cardboard looms: *Iron-holder;* both warp and weft may be of coloured string. Several layers of thick material should be used for lining. *Kettle-holder,* similar to iron-holder, but woven in wool. *Rugs for doll's-house, with fringes.* These are woven on oblong looms as already described. To make a fringe for the short ends, cut pieces of wool about four inches long; fold in half; insert the loop thus formed through the edge of the rug, and pass the two ends of wool through it (Fig. 19). *Table-cover* woven in wool of two colours. *Shawl;* for patterns for shawls see Chapter V on pattern-weaving. *Doll's Tam-o'-Shanter;* weave a woollen square, turn the corners to the centre and sew towards the centre from the corners. Leave an opening for the head by turning in the corners. Finish with a woollen tassel on top. *Doll's clothes.* Children enjoy thinking out looms on which to make clothing for their dolls. They will often be found doing this in free activity periods. They cut the cardboard for the required shape. They soon see where to put notches to hold the warp thread; for example, in the loom for the sock shown in Fig. 20, the child has drawn horizontal lines about $\frac{1}{4}$ inch from each other across the sock. Where the lines touch the edges of the card, slight notches are made. It is strung by winding the warp round the loom in the notches. The wool is woven round the foot as shown in the diagram. To get

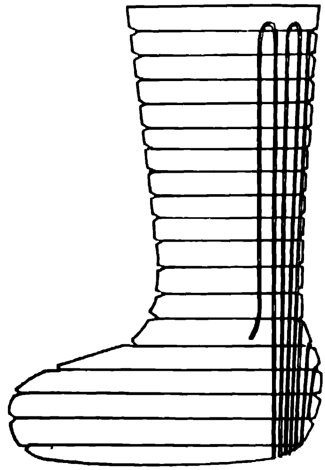

Fig. 20.—Loom for Sock.

an uneven number of warp threads, put two in one notch.

Weaving Simple Patterns

At first children are too interested in weaving or grappling with their looms to think much about patterns. However, they quickly notice the pretty effects of weaving with a colour that is a contrast to the warp or tones with the warp. Horizontal stripes are the easiest form of pattern in weaving, and very suitable for the rugs and mats, etc., that the children are so fond of making. Before beginning, let the children cut out of paper the size of the article they wish to make and on this draw stripes of various widths. It is interesting to see how many different effects can be produced. (For pattern weaving see Chapter V.) Without the introduction of new colours or pattern, weaving becomes monotonous. The weavers of long ago may have used different coloured grasses or dyed their weaving material with roots, leaves, berries (see *Weaving and Other Pleasant Occupations* (Harrap) for stories of weavers of long ago, their patterns and their dyes).

Some children may notice that when they weave they can get two different kinds of texture. If the warp is not too far apart, and the weft not too closely pressed together, an equal amount of warp and weft will show in the finished web, and if different colours have been used in warp and weft the result is an even check. This is the ordinary tabby weave. If the warp threads are farther apart and the weft very tightly packed, the warp will not be seen in the finished web, which will be thick and show only the weft colour. It is better not to teach children at first to weave in this way. They are hardly ready to appreciate texture, but if they discover it for themselves it is all to the good, as they will need the knowledge in more advanced weaving.

CHAPTER THREE

CARD-LOOM AND BOARD-LOOM WEAVING

Card-loom Weaving for Older Children

SO far the looms we have considered have been mainly simple rectangular looms suitable for the younger children.

The great virtue of the card-looms, as we have said before, is that "cloth" of special shapes such as those for tammies, berets, mittens, slippers, etc., can be woven. Older children especially like to make things they themselves can wear, or their mothers.

Figs. 21 and 22 show examples of looms for older children. To make these the children need awls or piercers. Bags of different shapes, pochettes, tea-cosies, slippers, etc., can be woven. The shape is first carefully planned and drawn; then holes are pierced at regular intervals, as in Fig. 21. In the case of the slipper-loom, a pair of soles of the right size is bought, and from these the measurements for the loom can be found. Rings are indispensable when using weaving cards for bags of fancy shapes, tea-cosies and slippers; for example, to thread the slipper-loom (Fig. 22) a small ring is sewn at A. Thread a needle with a piece of raffia for the warp. Put the thread through E, leaving an end to be woven in, or make a knot. Carry the thread from E to D (Fig. 22); then behind the loom to G, from G across to F, behind to K, and so on. When B is reached, the warp passes through the ring until hole C is reached.

A set of good patterns, either bought or home-made and well tested, should be kept. The children make their looms by pricking through the holes in these. Dryad Handicrafts, Leicester, supply good-shaped card-looms, the outline of the shape is printed with dots for piercing, and instructions for weaving are given. Raffia and cotton yarn are suitable materials to use for warp or weft. Macramé twine can be used to make a strong warp. Slippers are best woven on a macramé twine warp, using thick material for weft, such as four-ply wool or raffia. All materials necessary for card-loom weaving: soles (children's sizes 11 and 13, and women's sizes 3 to 6), rings, piercers, needles for weaving (those with large eyes and turned-up points), macramé twine, raffia, wool, etc., as well as a variety of card-looms, can be obtained from Dryad Handicrafts or other Educational Supply Stores.

Although bought looms are more convenient and leave the children more time to concentrate on the actual weaving, it must be remembered that their own attempts at making looms, however poor, are of great value. Weaving on bought looms may become mechanical. With boys especially, half the pleasure is in thinking out and making a loom rather than weaving on it.

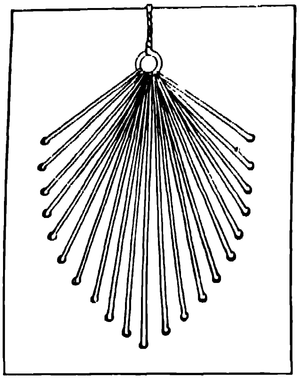

Fig. 21.—Loom for Bag.

Circular Looms (Figs. 23 and 24)

Many children see the possibilities of circular looms and want to make them. It spoils their pleasure if they are given a bought pattern too soon. It is a shape that lends itself to many modifications. Cut a circle $6\frac{1}{2}$ inches or 7 inches in diameter. A saucer or lid of a tin can be used for drawing around. About $\frac{1}{4}$ inch within the circle draw another, and divide the circumference of the inner circle into an uneven number of notches in the following way. Draw the diameter. Divide half the circumference into an equal number of notches not more than $\frac{1}{2}$ inch apart. By taking on the compasses or a piece of paper a measurement smaller (by the tiniest fraction) than one of these, it is possible to mark off an odd number of notches on the other side (19 in Fig. 23). Number these as in Fig. 23. At A, the starting-point, cut down the diameter to the second circle, cut V-shaped notches to the points on the inner circle. To thread the loom: tie a knot at one end of the warp and slip it into the slit A. Pass down the diameter to the opposite notch, behind to 1, across the centre to 1′, behind to 2′, and across the centre to 2. Go on until all the threads are crossed in the centre and the loom is threaded. Begin at the centre, and weave round and round. Pull the first round up very tightly, and as the weaving goes on, push the woof well towards the centre in order that the web may be firm. When the web is taken from the loom, there will be loose loops. Gradually pull the weaving from the centre to the end of these loops. Slip the finished "mat" off the loom. It can easily be shaped into a doll's hat or tammy. To make a tammy, run a piece of elastic or wool through the loops when taken off

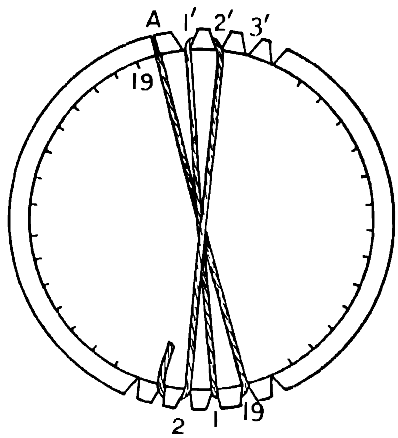

Fig. 23.—Circular Loom.

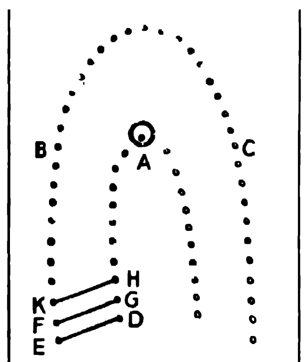

Fig. 22.—Loom for Slipper.

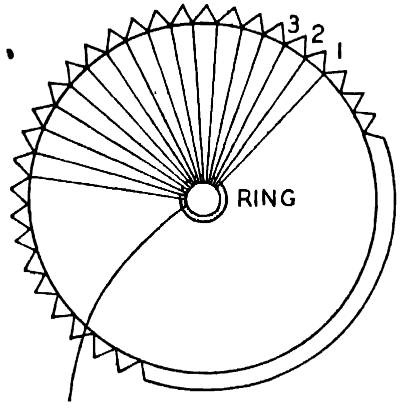

Fig 24a.—CIRCULAR LOOM WITH RING IN THE CENTRE.

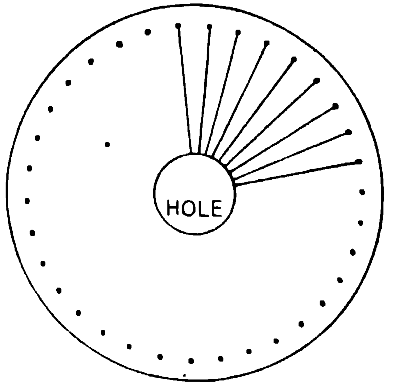

Fig. 24b.—CIRCULAR LOOM WITH HOLE IN THE CENTRE.

the loom; draw in to the required size. The children make hats of different shapes from their weaving.

Another way to thread the loom for making a mat is to sew a small ring in the centre of the loom (Fig. 24a). Tie the warp to the centre ring. Carry it to notch 1. Pass it behind the point to notch 2. Thread through the ring and carry it to notch 3. Continue until the loom is strung. The ring makes the weaving easier for the children. On the whole weaving on a circular loom is easier than any of the others, but it is a difficult loom for children to prepare. A third way to make a circular mat for hot dishes, etc., is to cut a circular piece of cardboard (Fig. 24b). In the centre cut a circular hole 1 inch in diameter. Draw a circle $\frac{1}{4}$ inch from the outer edge, and on this mark with compasses or dividers dots about $\frac{1}{2}$ inch apart, remembering to have an odd number. Make holes through the dots. Tie the warp at one of these holes, take it down to the centre hole, through this, up at the back through the next hole, down the front, through centre, and so on. It is an easy loom to warp. Start weaving as near the centre as possible. Weave until one side is finished, and then work the other side. When finished, the superfluous cardboard is cut away at the edge. This makes a flat, thick mat as the cardboard is left inside. The edge may be finished off with a narrow plait or twisted cord (see Chapter VI). Most attractive mats are made by varying the weft so as to obtain bands of colour. As the warp is closely packed towards the centre, its colour predominates, but gradually disappears towards the circumference where it is much more widely spaced; here the colour of the weft predominates. Children are most

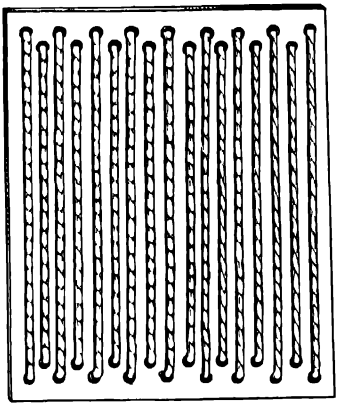

Fig. 25.—LOOM FOR FINER WORK.

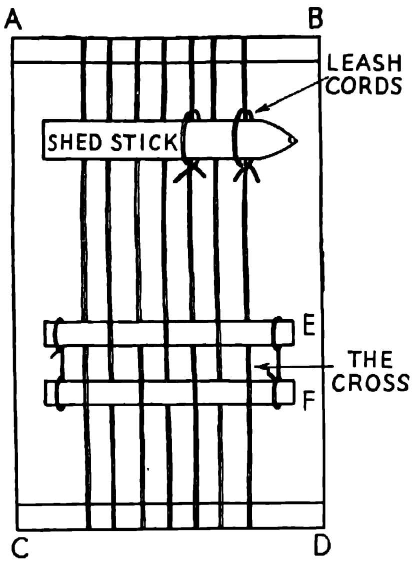

Fig. 26.—Board-loom.

interested in the effects they can produce.

A number of things can be made from circular looms, such as mats, hats, tammies, pin-cushions, needle-cases, table-covers for round doll's-tables, circular cushions for the doll's-house. For mats, string and raffia are very effective. The top of a child's hat or a doll's hat can be woven in wool, perhaps scarlet or navy; a strip the depth of the crown, or deep enough to turn up, may be woven on a rectangular frame and sewn around the top. For pin-cushions weave two small mats. Lay a smaller piece of circular card on each, turn edge of weaving over it, tacking it to keep it in place. Place them back to back and sew the edges together. For a doll's cushion, weave a small mat, line it with some soft material, stuff it with cotton-wool or short lengths of wool, or any waste material cut up into small pieces.

Fig. 25 shows how to make a loom for fine work. The two rows of holes allow them to be closer together, and there is less danger of one hole breaking into another.

The work on all these looms is done with a needle, and is really darning.

The Board-loom (Figs. 26 and 27)

Weaving on a board-loom is far more valuable than weaving on the card-looms described. It brings one nearer to the craft of weaving. The chief drawback to the card-loom, as we have pointed out, is that the child is not really weaving but darning. In a sense card-looms are a better introduction to needlecraft than to weaving. The warp threads are so close to the cardboard that they allow but little scope for raising or depressing them, so the work tends to become somewhat tedious and is slow. The board-loom is a useful loom for introducing children to the real craft of weaving. The boys and girls enjoy a loom where they can play at being weavers. Any flat piece of wood about 12 inches to 18 inches long, 6 inches or 7 inches wide, and $\frac{1}{2}$ inch thick will make a board-loom. A strip of wood an inch wide, and half an inch thick should be nailed at each end *to raise the warp off the board* (AB and CD in Fig. 26). The corners of these two pieces should be rounded as in Fig. 27, to prevent them cutting the warp. The loom should be made as smooth as possible with glass-paper. The children have to find or make various things for their loom. (1) The *shed stick* or *sword* (Fig. 28); this is a thin, flat, smooth piece of wood about 9 inches long and

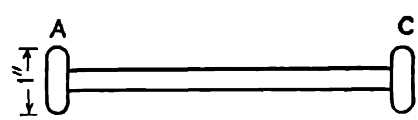

Fig. 27.—Side View of Board-loom.

shaped like a paper-knife; that is, one end is pointed. This is used to open the shed and to beat up the weft. (Children will find an ordinary comb of great help in pressing the weaving together.) (2) The *shuttle* on which the weft thread is wound, and which passes through the shed from side to side. An ordinary knitting-needle, 7 or 8 inches long, makes a good shuttle; packing-needles are also useful for practice work, but children like to have a shuttle more like the real thing. Shuttles can be bought from Dryad Handicrafts, but many children like to make their own from cardboard, as in Fig. 29. (3) The rods E, F, for making the cross (Fig. 26). These rods are two pieces of ⅜-inch dowel rod, 7 inches long. The rods sold for light curtains are suitable. The two rods are inserted in such a way that each thread passes alternately over and under each rod while *crossing* another between the rods; Fig. 26 shows this clearly. This cross or *lease* is a clever, though simple, arrangement to prevent the threads comprising the warp from getting entangled. It is not so necessary on the small board-looms, as there are comparatively few threads, but it is necessary when weaving broad material, and it does separate the warp into an upper and lower layer and help to make the shed through which the shuttle passes. "The cross" is the one thing common to all looms and necessary for making the first shed.

Method of using the Board-loom

Older children can learn a great deal

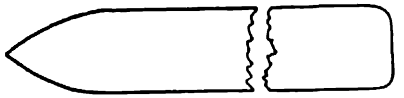

Fig. 28.—Shed Stick or Sword.

Fig. 29.—Shuttle.

about the weavers' craft from using this loom.

Warping

Small screw eyes are put into the loom to enable the beginning and the end of the warp to be safely tied. Wind the warp carefully round the board. Do not wind too tightly, as it will be difficult to move the work round the loom when weaving is begun. Keep the tension as nearly as possible the same; tight winding in some places and loose in others will spoil the look of the finished cloth. Any knots should be arranged at the end of the loom where the weaving began. The spacing of the warp threads is, of course, important.

Making the cross or lease; the necessary threads may be raised with a knitting-needle to enable the rods to be put in place more easily. They should be firmly tied together as in Fig. 26. If this is done correctly, the warp will now be separated into two distinct layers; if the upper contains the threads of even numbers, then the lower one will be made up of the odd numbers. The space between the layers is known as "the shed" (Fig. 30). If the shed stick is passed through this and turned on its edge, the opening will be large enough for the shuttle to be passed through.

The shed stick makes one shed, but when the shuttle has passed through this, another shed must be made by *raising* the *lower* layer of thread. This is done by making a loop round each thread of the lower layer to enable it to

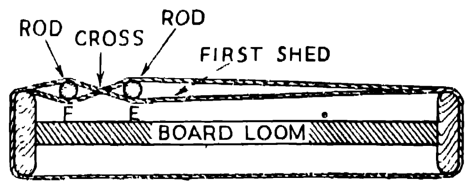

Fig. 30.—Board-loom, showing first Shed.

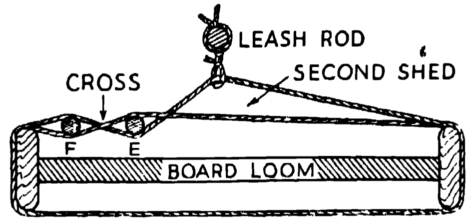

Fig. 31.—Board-loom, showing second Shed.

be pulled through to the top. Each loop must be of the same length to ensure that each warp thread is lifted to the same height, but this can be readily done if the shed stick is laid across the warp and each loop tied around it as well as the warp thread (Fig. 26). The ends of each loop are tied to a piece of dowel rod, a *leash rod* (Fig. 31), so that they can be lifted easily. The loops are called the leash cords. When the leash cords are ready, the lifting of the leash rod, as in Fig. 31, should raise the lower layer of warp threads through to the top, and so form the second shed, as in Fig. 31; this can be held open when necessary by the insertion of the shed stick. Great care must be taken to see that the loops are tied in such a way that they will pull the warp threads through the correct spaces, and that only *one* thread of the lower layer is brought through any *one* space.

Weaving

When weaving, the work is often quicker if two shed sticks are used. The loom is placed in front of the weaver with the cross at the end farthest away. A shed stick is put between the warp layers near the cross and left there. When the first shed is to be opened, this is turned on its edge, and the other shed stick used at the front to make the shed large enough to enable the shuttle to be passed through. The second shed is made by a sharp pull on the leash rod; this will bring the lower warp threads up in the right position (Fig. 31). The free shed stick is put in and turned on its edge, when it will hold the shed open. Weaving proceeds in this way; the first shed is opened and the shuttle containing the weft is passed through. The second shed is made and the weft is passed back again. The shuttle is passed from *right* to *left* through the first shed and from *left* to *right* through the second. This is repeated throughout the work. It seems easy, but the greatest care is needed for good work. The length of the weft allowed in each shed must be the same; it is a good plan to hold the edges of the warp when the weft is turned, or the result will be a series of loops or dents along the edge. Many of the older children enjoy working at these looms until they can weave a piece of cloth with good edges, and keep it the right width. The spacing of both warp and weft is of the greatest importance. Pattern weaving is almost impossible without it. If children use warp of a different colour from that of the weft, they will learn a great deal and faults are revealed at once. These lessons can be used for weaving belts, scarfs, ties, rugs, mats, bags, slippers, etc. Bed socks or shoes of all sizes are easily woven and make a useful gift. They are made without soles and are intended to be drawn up round the ankle.

Weave a mat about 9 × 12 inches. Double one of the short edges and sew over and over on the wrong side. This is the toe. The two long edges now lie together. They may be sewn together, or crocheted or knitted with a suitably coloured wool by holding them close together and puckering a little. This makes a pretty seam on top of the foot and in front of the ankle. The top may be finished by crocheting a border and running a ribbon or plaited woollen strand through it. Baby shoes are made in the same way. To find out the length of material to be woven, measure the sole, then up, back of the heel, to the point desired above the ankle. For the width, measure around the foot. Cuffs of wool for winter can be made, and sleeve protectors of raffia. Children, however, are especially fond of making rugs or mats. A rug 10 × 7 inches is a suitable size for a doll's-house. Little rugs are useful, too, as a stand for the telephone or to sew together to make large rugs. Rug yarns should always be *broken*—not cut. Cutting wool leaves a blunt end which is always unpleasantly visible. Start the new piece a few warp threads back (about an inch), being careful to go over and under exactly the *same* warp threads as when finishing the end. It is best to run the threads past each other near the *middle* of the mat rather than the sides. The children quickly learn this method of splicing. These looms are excellent for practising patterns that can be used later for larger work (see Chapter V). Boys like to experiment and make board-looms of different kinds; old picture-frames can be converted into good looms. Further examples of cardboard looms and varied looms will be found in *Weaving and Other Pleasant Occupations* (Harrap); and more about board-looms in *Handloom Weaving* by P. Orman (Pitman's "Craft-for-All" Series). This latter book is useful for teachers who want to take up simple weaving as a hobby, as well as for school work.

CHAPTER FOUR

BOX-LOOMS AND HEDDLES: THE CRAFT OF WEAVING

WITH shed sticks and leash rods weaving is much quicker, and a number of small articles can be made in a comparatively short time, such as small scarfs, hatbands, ties, pochettes. Woven strips, if the edges are straight, can be sewn together to make large bags or coverlets. But children of the Primary School age are too active to be content with long periods of weaving, and rightly the intelligent ones want to know more. Boys especially want to experiment. Very soon it is discovered that boxes make fine looms, more like real machines than the board-looms are. Cardboard boxes and wooden boxes of all kinds can be experimented with. Through the box-loom both children and adults are able to get a good understanding of what weaving really is, or the craft of weaving. Card-looms and board-looms are often held so that the warp is vertical, but in the real loom the warp is horizontal. Working on a simple box-loom helps one to understand the principles of the larger looms. Fig. 32 shows a box-loom with a rigid *heddle*. Parts of the long sides of the box are cut away so that the shuttle can pass to and fro easily.

Instead of the shed sticks and leash rods for making two different sheds, a clever contrivance called a *heddle* can now be used for raising and lowering alternate warp threads and making the two sheds. We do not know when a heddle was first used. They were made of bone, wood, and metal. Fig. 33 shows a child's heddle made of cardboard, Fig. 34 a heddle made of threads for finer work. The working of the heddle is easy to understand. In the case of Fig. 33, one warp thread goes through a slit in the heddle, the next through a hole, and so on. When the heddle is raised as in Fig. 32, the threads passing through the holes are raised, while the others which are free in the spaces remain horizontal; thus the first shed is made. When the heddle is depressed, the threads in the holes are pushed *below* the free horizontal ones and a second shed is made. A *shallow* board-loom cannot have a heddle, since it would be impossible to depress it. A box must be used that is deep enough to admit of the heddle being pushed down far enough to make a second shed. A rigid heddle like Fig. 33 is useful as a beater or batten to beat the weft together; it also helps to regulate the width of the cloth. Children think of different ways of making heddles; for example, Fig. 33 can be made of strips of wood nailed to two cross-pieces. A narrow space for the free warp is left between each strip; holes are drilled in the middle of each strip for the alternate warp threads.

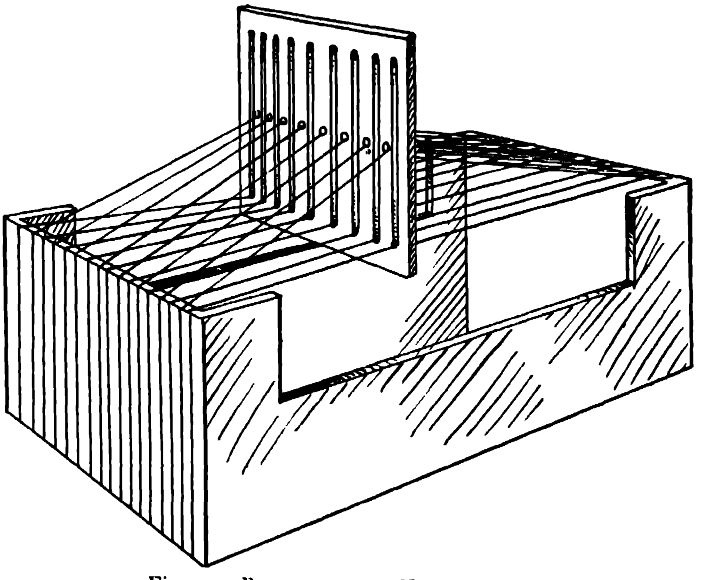

Fig. 32.—Box-loom with Heddle raised

The heddle shown in Fig. 34 for fine work is a little more difficult to make. The framework is made of thin strips of plywood. The heddle strings have a loop in the middle through which certain warp threads will pass. These loops must be as high as the top of the box, no higher. To make these heddle strings or *healds*, drive two $1\frac{1}{2}$- or 2-inch nails (without heads); (A, B in Fig. 35) into a piece of wood. The distance apart will depend on the height of the loom. In general, the heddle should be broad enough to slide up and down in the box, and twice as high as the box. Draw a straight line from A to B and mark the middle point between the two nails. Drive in two other nails (C, D in Fig. 35), each about $\frac{3}{8}$ inch from the middle point. With this simple apparatus any number of heddle strings or leashes can be made. Take some cotton, a little longer than twice the height of the heddle. Fold it in half and put it round nail A. Take the two ends on to the second nail, C, and tie them tightly below this nail (Fig. 35): now take them below the third nail, D, and tie again. Lastly, take them below the fourth nail, B, and tie. There are now two long loops and one short one. The knots must be tied firmly enough to withstand a good deal of pulling. Make as many strings as are required, the number depending on the width of the cloth. To fasten the strings on the frame, thread through the long top and bottom loops strips of thin wood, EF and GH in Fig. 34, and nail them to the top and bottom of the frame, Fig. 34. Each strip of wood EF and GH is pulled to stretch the leashes before the nails are driven home. More than one heddle can be used. More heddles are needed if patterns are being woven: for example, the twill weave, etc. (see Chapter V on patterns). For homeworkers not more than four heddles are necessary; many hundreds of patterns are possible with these. Some of them are shown in Chapter V.

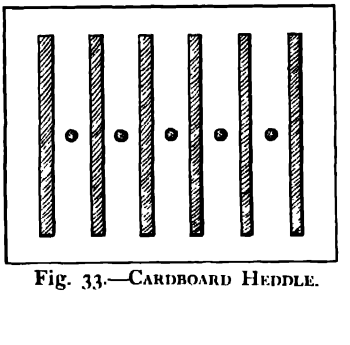

Fig. 33.—Cardboard Heddle.

Heddles in a variety of sizes can be bought; many are made of metal. Small heddles that take thick rug wool are suitable for younger children. They enjoy weaving strips that can be sewn together to make floor mats. Small heddles also make bands, belts, braids, girdles, ties, trimmings, etc. Children may like to know that a group of heddles is called a *harness*.

Fitting a box-loom with a heddle gives many children much pleasure, but boys are even more pleased to think of ways of putting rollers on their toy looms, so that the finished cloth can be wound up on one roller, while the warp threads are unwound on the other.

LOOMS WITH ROLLERS (Fig. 36)

On the looms the children have made so far they have only been able to weave a piece of cloth about the size of the loom, or about twice the size of the loom if it is a board-loom, and the work is moved around the loom. The need for weaving longer strips soon arises. Boys often think it is quite easy to add rollers made of broom handles at each end of their toy loom. But there are a few difficulties. One difficulty is to make some arrangement to prevent the rollers from *unrolling*, and so slacken-ing the warp tension and making weav-ing impossible. This applies especially to loose rollers. Fig. 36 shows a simple box-loom with rollers, adapted from a cardboard or wooden box. The long sides A have been lengthened to allow for rollers. Before the strips for lengthen-ing the sides are fastened on, holes are made for the rollers, as in Fig. 36. Rollers are made of broom handles, curtain rods, or 1-inch dowel rods, according to the size of the loom. To prevent the roller from unwinding, to each end of the roller a circular disc of cardboard or plywood is nailed and glued. Each disc has a series of holes made in it near the circumference, $\frac{1}{2}$ inch apart (Fig. 37, H). Similar holes are drilled into the side of the box (H in Fig. 36), so that a nail or peg can be inserted through a hole in the disc and into a hole in the side of the box, thus preventing the roller from turning when necessary. It will probably be sufficient to have these discs on one side of the rollers only. Some boys will soon discover that large screw eyes, the eyes at least half an inch in diameter, can be used for holding rollers, as in Fig. 38. Extra strips of wood (A in Fig. 38) are added, into which the eyes are screwed. These strips leave plenty of room between the box and the roller for a good deal of warp or finished cloth to be wound on the rollers. Children think of many ingenious ways of keeping the rollers from turning. Descriptions of other home-made looms will be found in

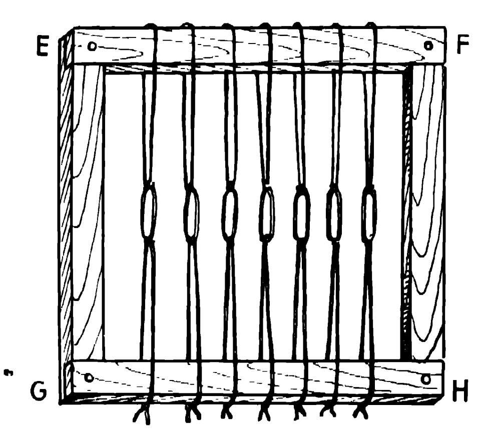

Fig 34.—MAKING HEDDLE STRINGS OR LEASHES.

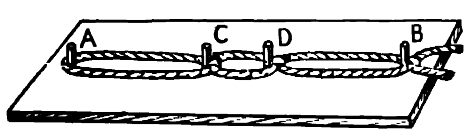

Fig. 35.—MAKING HEDDLE STRINGS OR LEASHES.

Weaving and Other Pleasant Occupations (Harrap). Box-looms and table-looms can of course be bought, but they are expensive, and one doubts if they are of as much educational value as those made by children themselves, especially at the Primary School age.

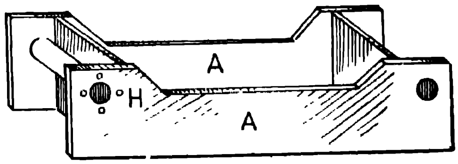

Fig. 36.—Box-loom with Rollers.

The Reed (Fig. 39)

The children have learnt how to pack the weft together (the "filling" as it is sometimes called) with the sword stick or shed stick, a rigid heddle (a heddle *not* made with string), or a comb. They should be told about the *reed*, the special contrivance for beating back the weft in cloth-making, though there is no need for them to make it or use it. The reed, or reed batten, is an appliance which was used quite early in the development of the weavers' craft. It has not been mentioned before because on all small looms its place is taken by the shed stick or rigid heddle. It has two chief uses, to keep the warp *equally spaced,* and for battening up the weft. It got its name from the fact that it was originally made from a series of reeds fastened together at the top and bottom, the warp threads being carried between the reeds. These were only suitable for coarse work; modern reeds are made from strips of fine steel fastened into a framework (Fig. 39). There is no easy way of making these; they must be bought. However, they are not needed in the Junior School. They are mentioned here because some bright children are sure to ask about them.

The children can now play at being weavers, making the sheds and throwing the shuttle through the shed from hand to hand. They notice it takes a little time to make the different sheds, and many will guess what the next invention must have been, a treadle for raising and lowering the heddles. This left the hands freer for throwing the shuttle and beating up the weft. A swinging batten was also added.

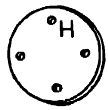

Fig. 37.—Cardboard Disc for fixing Rollers.

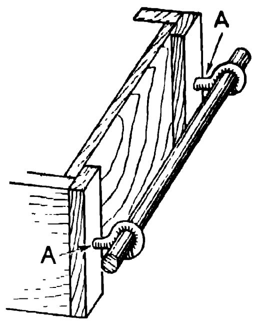

Fig. 38.—Large Screw-eyes used for Rollers.

It was not until the eighteenth century, in the reign of George III, that any more changes were made. Then we get the clever invention of the *fly shuttle.* Because of their own experiments, the children are able to appreciate this invention. They know well how the shuttle is thrown from one hand to the other through the open shed, leaving a line of weft, and how the batten beats close the line of weft. Both hands had to be used, but with the fly shuttle the jerk of a peg with the right hand sent it

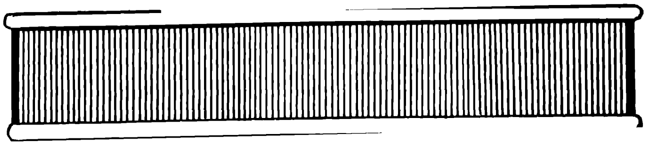

Fig. 39.—The Reed or Reed Batten.

flying from the shuttle-box on one side to the shuttle-box on the other. This leaves the left hand free to beat up the weft with the batten. The fly shuttle also meant that broader cloth could be woven. Up to its invention, cloth could only be as broad as a man could throw a shuttle from hand to hand.

Groups of children who have arrived at this stage should be taken, if possible, to a School of Weaving and watch an expert weaver at work. Because of their own crude attempts at making looms, there are many things they will notice at once and understand—the heddles moving up and down, the hanging batten, the rollers or beams, the cross or leash, and above all the fly shuttle racing through the shed from one shuttle-box to the other with just the jerk of a peg. Without their own experiments and efforts, the loom would be almost meaningless to them, and the explanations mere words. One learns most from what one tries to do oneself. Seeing a school craft being carried on in the bigger world adds significance and dignity to the school craft, and intelligibility and interest to the maturer one of the big world.

CHAPTER FIVE

SIMPLE PATTERNS AND DESIGN IN WEAVING

MANY simple ways of decorating plain weaving are possible for children; indeed, pattern is part of weaving, for it must come from the construction. This is true of nearly all crafts—power to design should grow with the growth of craft knowledge, with the understanding of the material used. In weaving it is especially obvious that patterns should come from the construction, since the fabric must be made by the crossing and interlacing of threads at right angles to each other. The primitive basket-weavers were surely the first to arrive at cross-lines, and upon these a vast amount of varied and beautiful pattern has been built up, the simplest forms of which are the *lattice* and the *chequer*. Grasses of all one colour show the lines of interweaving, the lattice. Grasses alternately light and dark in colour give the chess-board pattern, or draught-board pattern as the children call it. (See *Weaving and Other Pleasant Occupations*, Harrap.) The enormous number of ways in which, in weaving, the threads can be crossed and interlaced show that thought can always produce something fresh. "Design or invention is something *not all* ours, which we find and make our own."

The simplest weave and the most common is called the *plain weave* or *tabby weave.* This shows the draught-board pattern, for in this weave the weft intersects the warp in such a way that it passes alternately over and under consecutive threads so that both warp and weft show nearly equally on the surface of the cloth. Interesting effects or patterns can be obtained in tabby weaving by changing the colours of various threads.

(1) Changing the colour of the weft or part of the weft; this gives horizontal stripes (Fig. 40). This was perhaps the first decoration used in weaving, and will naturally be the first chosen by the children. Let them make experiments in arranging bands of colour. They can experiment by means of coloured paper or painting. It must, of course, be remembered that in plain or tabby weaving these stripes will never be pure in colour, since the warp will show through, as in Fig. 40.

(2) Changing the colour of the warp or part of the warp (Fig. 41); this gives vertical stripes. When children have experienced the pleasing effects of stripes running *across* the web, they will probably want to produce stripes down the length of the material. Changing the warp means more thought, because the effect has to be planned in advance, for the different colours are introduced into the warp.

(3) Changing the colour of both weft and warp. This method gives endless

variety. Children enjoy experimenting on their board-looms. Many workers discover plaid patterns by happy chance. Plaids are obtained by stringing the warp at regular distances with the colours used in the weft, and in the same order; for example, in the warp are six brown threads, followed by six blue. If a narrow scarf is being woven, arrange the warp so that there are three sets of brown warp threads separated by two sets of blue. Begin to weave with a blue weft. Weave for about the same width as the set of brown warp threads. Now weave the same width with a brown weft, then the blue again, and so on. There is no need to tie the blue and brown wefts together; leave an end to be darned in if necessary. Further variations in the proportion of blue or brown weft will give other patterns.

The warp might also be arranged as follows: one scarlet thread, three navy, one scarlet, three navy, and so on. Then there should be in the weft two threads of scarlet followed by seven of navy, then two of scarlet, seven of navy, and so on. The children should experiment and make notes of the colour effects for future use. More than two colours may, of course, be used. A more interesting plaid may be made of stripes of varying widths of red, blue, and white in the warp, with the same colours woven across. The children will notice that there is only pure red where red weft crosses the red part of the warp, and pure blue where the blue weft crosses blue; where different colours cross, a speckled effect is obtained. It is better not to change the colours of the weft too frequently, as it is difficult to keep the work neat. The patterns, the children can discover, are endless, and a vast field of experiment lies open to them.

Patterns made with Weaves

We have already described the tabby weave. Other interesting and decorative weaves are:

(1) *Twill weaves* (Figs. 42, 43, 44). After the tabby weave, the twill weave is most common. Hitherto the weft has been threaded regularly under one and over one warp strand. It is now taken under and over *two* or more warp threads. Over two and under two (Fig. 42) perhaps makes the prettiest twill. It is a great favourite among Eastern races for outside matting for walls of houses. The *first row* goes over two, under two, etc.; *second row* (coming back), under *one*, over two, under two as before; *third row*, under two, etc.; *fourth row* (coming back), over *one*, under two, etc. The intersection of the threads in this weave produces characteristic lines diagonally across the web, most often at an angle of 45 degrees. Fig. 43 shows the pattern produced by reversing the steps at intervals. Over two and under two is the most common twill.

Fig. 44 shows a twill made by weaving over one and under three. A

Fig. 40.—Changing Colour of Weft.

Fig. 41.—Changing Colour of Warp.

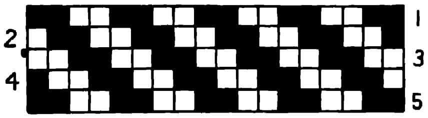

Fig. 42.—Twill Weave.

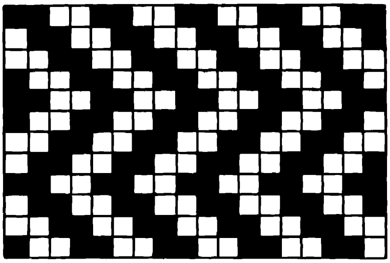

Fig. 43.—Twill Pattern Reversed.

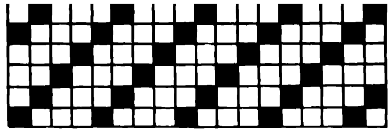

Fig. 44.—Another Twill Pattern.

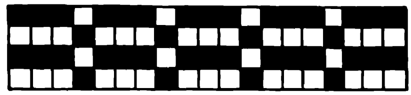

Fig. 45.—Basket Pattern.

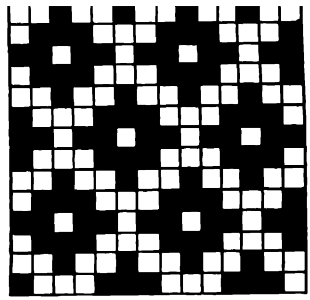

Fig. 46.—All-over Pattern.

"basket effect" (Fig. 45) is produced by weaving over three and under one, reversing the process in alternate rows.

Experience in weaving the simple twills shown in Figs. 42 and 44 will suggest a number of attractive "all-over" patterns, as shown in Fig. 46.

In the *sateen* weave nearly all of either the warp or the weft threads are on the surface, the object being to produce a smooth surface fabric like sateen. But workers should not use a pattern which involves weaving under or over more than five strands at a time, as this would make the material too loose to be of any practical use. Patterns can be worked on squared paper, as in Figs. 42, 43, 44, where the space between any two adjacent parallel lines represents one thread. Older pupils can use a page of an ordinary "graph" exercise book. Many children enjoy working out patterns on squared paper. Other patterns may be obtained by making variations in the sizes of, or the kind of, materials used in the warp or the weft, and in many other ways, but Junior children should only attempt some of the simple decorations suggested. Texture has been touched upon in Chapter II, but in the Junior School children are naturally more interested in colour than in texture. It is best to leave a study of the beauty, feel, and use of textures for the Senior School, unless any Junior children discover it. Soon children are very sensitive to the feel of things, and perhaps the development of the sense of touch tends to be neglected in schools. It is therefore abundantly wise to let the children have opportunities for handling varied materials in the free activity periods (see sections on Art and Clay Modelling), so that expressions such as "soft as silk," "smooth as satin," have a real meaning.

CHAPTER SIX

THE STORY OF A FLEECE: SPINNING AND OTHER ACTIVITIES

THE practice of the art of weaving came before spinning, that is why we began with weaving. When spinning was first discovered we do not know. The ancient Egyptians could spin, because cloth has been found in their tombs woven from finely spun flaxen threads; drawings on Egyptian monuments, which are among the earliest records, show "the simple spindle of wood or even plaited rushes, with a head of gypsum to give it momentum while spinning." There are allusions to spinning in the Bible, "And all the women that were wise-hearted . . . brought that which they had spun, both of blue, and of purple, and of scarlet, and of fine linen. And all the women whose heart stirred them up in wisdom spun goats' hair" (see Vol. II, RELIGIOUS INSTRUCTION and Chart II, RELIGIOUS INSTRUCTION). The spindle-whorls found in British pit dwellings and tombs show that the art of spinning was practised in the Bronze Age. Figures of spinsters are to be seen on ancient Greek vases. There is one in the British Museum dated 500 B.C.

Children who have been weaving wool and making primitive looms are sure to ask how woollen threads are made. Let them unravel one and notice the short fibres that compose it. It seems almost a miracle that these can be twisted together to make a strong strand of wool. Almost every child will want to try to spin. Let them act out the story of all the many processes that wool passes through before it becomes yarn.

SCOURING THE FLEECE

Get part of an unwashed fleece or, better still, a whole fleece from any of the weaving schools or Dryad Handicrafts. Steep it in cold water overnight. Then wash it several times in warm soapy water, changing the water frequently. Rinse well. The wool has to be handled as lightly as possible, and not rubbed, otherwise a terrible matted tangle will be made. When the water left is fairly clean, the fleece is hung up or spread out to dry. To children who have seen a whole fleece, the story of Jason and the Golden Fleece has much more meaning (see *The Heroes*, by Charles Kingsley).

TEASING THE FLEECE

The second process is "to tease" the fleece—that is, to pick it over little by little until it is fluffy. This gives delight to the workers, because they may find a piece of moorland moss, here and there a twig, a thorn, or bits of brown fern. The children realize that the fleece in their hands, which will perhaps be yarn tomorrow, was yesterday really on the back of a sheep, far up on the bare moorland, or on the sheltering downs of

the South. Although the fleece needs so much washing and picking, remind the children that the farmer arranges for sheep-washing before the shearing.

Oiling and Carding

The washing removes all the natural grease. To make spinning easier, the wool must now be oiled; the best oil is third-pressing olive-oil (below human-consumption grade). It is oiled until fairly greasy. The problem now is how to get out the separate fibres from the fluffy handfuls of wool. Children think of the tools that might be used, and will probably suggest combs, or something bearing teeth. If possible, show them pictures of wooden and horn combs belonging to primitive people. They will now appreciate the *cards* used by hand-spinners today. They are two flat pieces of wood with handles. The wood is covered on one side with leather into which are inserted over the whole surface bent wires turning towards the handle (Fig. 47). These are used to brush the wool into order for spinning; they can be obtained through any school of weaving. When carding, sit on a low stool so that the feet rest on the ground. Take one card in the left hand, resting it on the lap with the wires uppermost and the handle pointing to the left. On this put a small portion of oiled fleece; take the handle of the other card in the right hand, the forefinger stretched out on the card's back in the traditional way (Fig. 47, *a*). Draw this card several times across the left card until almost all the wool is on the right-hand card. Now it must be got on to the left one again. This is done by turning the left-hand card and pointing both handles towards the worker (Fig. 47, *b*); then push the right-

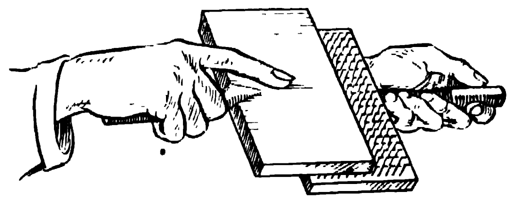

Fig. 47a.—Carding. The Cards have Bent Wires turning towards the Handles.

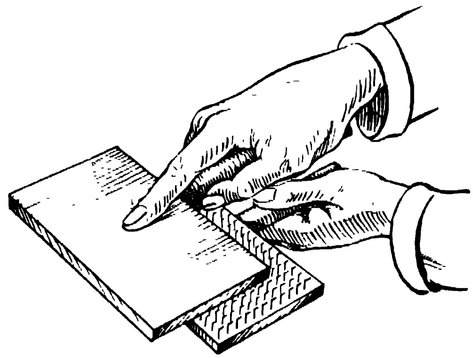

Fig. 47b.—Carding.

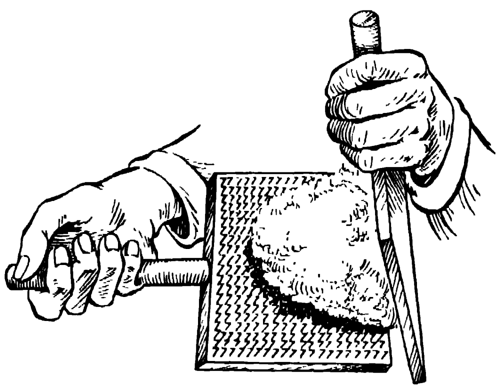

Fig 47c.—Carding.

hand card across the left. This process is repeated several times. The wool which is on the left-hand card is removed by placing the cards as in Fig. 47, *c*; and scraping the left-hand card down across the edge of the right. Lift the wool by drawing the left-hand card lightly upwards, and drop it on the *back* of the right-hand card, where it is

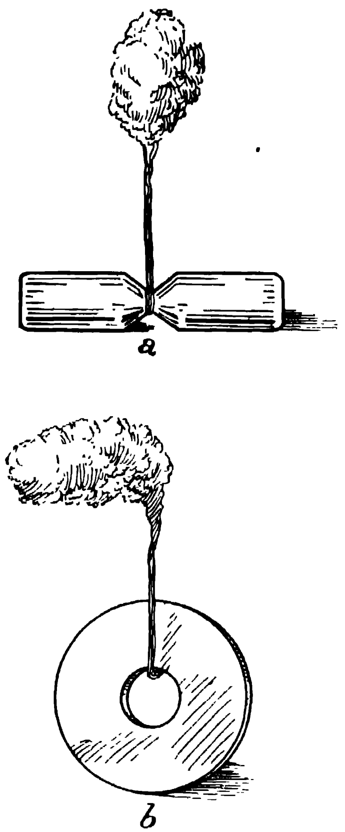

Fig. 48.—CHILDREN'S SPINDLES.

rolled between the two card backs into a neat sausage roll known as a "rolag."

SPINNING

Now we come to the actual spinning of the short fibres of wool into a continuous thread. Spinning consists of binding together a number of loose filaments into one strand by means of *twisting;* spinning is really twisting.

HAND-SPINNING

The simplest form of spinning was done entirely by hand. No device of any kind was used. The fibres were pulled out (really thinned out) and twisted. Let the children try drawing out a rough sort of strand from the rolag and twisting it between their thumbs and fingers. This is slow work. Some may find they get a better twist if they tie a stone at the end and spin it. Children like to take some wool and set about finding some effective ways of twisting it and making a strong strand. The result will probably be several types of spindle (Fig. 48). For a day or two the proud inventors will make earnest and interested efforts to produce good yarn with their crude tools.

SPINDLE-SPINNING (Fig. 49)

The children are now ready for spindle-spinning. The simplest form of spindle consists of a stick or rod of wood with either a hook, spiral, or a notch at the top. A thread is attached to it; by twisting between finger and thumb, a spinning movement is set up, and as the rod hangs suspended it twists the thread about; the "spin" runs up the thread into the already drawn-out fibres held closely to the thread and converts them into yarn while the spindle is at rest. The heavier the stick the easier it is to rotate and the longer will the motion last; therefore weights in the shape of wooden discs, balls of clay or wax were added, and the spinster had more time to direct her attention to controlling the amount of wool or flax to be twisted. "Even where there is no whorl," says Dr. Harrison, "the spun yarn that is wound on the spindle after a time becomes heavy enough to increase the spin to a perceptible extent. It may have been the observation of this fact that led to the invention of the spindle-whorl which is probably an earlier device than the thickening of the spindle itself."

Children will enjoy trying to spin on

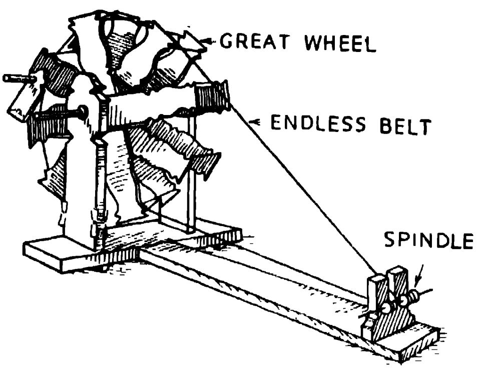

Fig. 51.—Earliest Spinning-wheel, India

because at one end of the stick a number of rolags are bunched up and tied (Fig. 50). This was held under the arm. This is how the housewife in Proverbs used to begin to make her purple clothing, "She layeth her hands to the spindle and her hands hold the distaff." The stick was generally a firm one about 3 feet long. Wind crushed paper round and round the stick near the top until you have a firm oblong ball, well bound on with tape. Then take a large bunch of well-prepared rolags, stretch them longways and double them round the core, the doubled parts downwards and the ends at the top. Tie a piece of tape firmly round the rolags near the top; the rest of the wool is bound loosely with pretty ribbon (Fig. 50). In Saxon times we find record of a fixed distaff, mounted on a stand, so that the spinster's hands had a little more freedom.

When trying to spin with the spindle, the children find that the hands have too much work to do—the twirling of the spindle, the holding (until the distaff was used) and thinning of the fluffy wool, and the important "nip" needed on the thread to prevent the "spin" running right up the mass of wool; some way was needed to relieve the hands.

The spinning-wheel; the next step was to fix the spindle horizontally in bearings and cause it to rotate by a belt passing over a great wheel which was first turned by the hand. These wheels have long been known in India. Fig. 51 shows one of the earliest. From a drawing on a fourteenth-century manuscript in the British Museum, it is clear that the wheel was known in Europe in the fourteenth century, though far from being in general use. Fig. 52 shows an early spinning-wheel for wool or cotton. The wheel is turned by hand. Although the wheel was turned by hand, the spinner's hands were left freer for drawing out the fibres than when they had to hold a spindle.

In the sixteenth century a greatly improved small wheel worked with a treadle was used for spinning cotton. Fig. 53 shows this small wheel or Saxony wheel. The big wheel was still used for wool. The treadle allowed the spinner to sit with both hands free to draw out the strands from the rolags or roves. Simple spinning-wheels that spun only one thread at a time remained in use until the wonderful inventions of the eighteenth century. To children

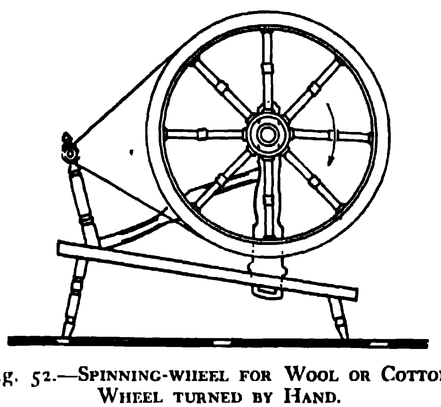

Fig. 52.—Spinning-wheel for Wool or Cotton. Wheel turned by Hand.

who know something about the early methods of spinning and weaving, the Industrial Revolution means something. The change was so great that it was a revolution. Without a knowledge of the past it is impossible to understand the present. The thundering looms and spinning-mills of Lancashire had their beginning when the first human beings began to weave and twist grasses.

If possible, children should be taken to a weaving school, where they can see spindle-spinning being done by an expert, and have a good look at the spinning-wheel that did so much good service up to the time of the Industrial Revolution. There are many things to notice—the bobbin or spool on the spindle on which the thread is wound; the little bent hooks that help to regulate the filling of the spool by the newly spun yarn or thread. They will be thrilled to watch the wheel at work, and still more if they are allowed to spin, or rather try to spin themselves. It will probably not be possible for the children to have a spinning-wheel of their own at school. The next best thing to bringing real things into the schoolroom is to go out of the school and see actual workers and processes. Some school excursions are almost worth a whole term's teaching. The picture the children carry away of a skilful spinner at work will be a beautiful memory to many all their lives.

Free Activities

Most of the activities in connection with spinning will be carried on in the free activity periods. The following occupations were chosen by children after hearing and experiencing the story of a woollen thread: (1) Trying to spin

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Fig. 53.—Spinning on Saxony Wheel with Treadle-wheel worked by Foot.

in different ways. (2) Nearly all the boys tried to make an Indian spinning-wheel like the one shown them in a picture (Fig. 51). It was a revelation to them that a wheel could be made of four pieces of cardboard or wood of equal lengths. (3) A group of children decided to collect pictures of spinners and weavers, spindle, spinning-wheels, and looms. They found pictures of Irish and Welsh women spinning. Old geography books, history books, advertisements, etc., were hunted through. Some old Dryad's catalogues were found of great use. In the end the whole class helped. The teacher was able to supply two Dutch pictures of Nicolas Maes, "De Spinster," and the beautiful print "The Spinners," by Velasquez. The result was a most interesting brown-paper "album" full of pictures carefully arranged under headings with a

few notes here and there where necessary. (4) Some children made individual booklets about spinning, in which they wrote about *hand*-spinning, *spindle*-spinning, and *wheel*-spinning, adding rough sketches where necessary. This project also sent the children looking through books; some consulted "the album," dictionaries, encyclopædias, etc.; help was also sought from the Free Library. It is most important that reading and writing should be encouraged in the activity periods. Children as soon as possible should be encouraged to make notes of what they are doing, trying to do or to find out. Some children like to do this in the form of a diary. If only one sentence is written, it is of value. It encourages thought. (5) One group of children decided to prepare and act for the class the story of the "Sleeping Beauty," because a spindle and spinning-wheel played an important part in it! There was a great discussion as to how the Princess could prick her finger with a spindle. (6) A few children wanted to find out why it was the little fibres clung together (see Vol. III, GEOGRAPHY, Chapter IX). The result was a study of the hairy covering of various animals. Samples of the hair of horses, rabbits, cats, etc., were obtained. Why are some of these used for spinning and some not? There are several reasons, of course. One will appear from an attempt to spin the hair. Hair is much more difficult to spin than wool. There is no exact demarcation between wool and hair (see GEOGRAPHY, Vol. III). Another reason is that some animals are more plentiful and accessible than others; for example, sheep are found everywhere, but the llamas only in Peru, and the yaks in the highlands of Tibet. Plate XVI, GEOGRAPHY, will give the children much pleasure because of its beautiful colouring and pictures of animals that give us wool and hair. A few children may get something from studying the different fibres under a microscope. (7) A group of children arranged an exhibition. Examples of hair, fur or wool were mounted on large cards together with pictures of the animals from which they are obtained. Notes were added saying if the fibre was useful for spinning, and if possible a sample of yarn or woven cloth was fastened to the card. (8) Some enterprising children began to twist raffia with surprising results, which led in the free activity period to group lessons on rope-making. This introduced the children to an occupation that was very popular for some time. We give here a few notes for teachers whose children may be interested in raffia twisting.

RAFFIA TWISTING (Fig. 54, *a, b, c, d*)

A strong pin is needed to pin the raffia to the clothing that covers the knee (Fig. 54, *a*), or the raffia can go round a large hook tied to a chair. Take about six strands of raffia (more if a thick rope is needed). Hold these strands in the middle and with the left hand twist outwardly the half on the left until about 2 inches are twisted. This twisted portion must then be placed behind the head of the pin (Fig. 54, *a*) or over the hook, and the two ends drawn forward, one in each hand. Now continue to twist these ends to the left, but at the same time bring the end in the left hand *over* the one in the right, changing each into the other hand; twist each end separately again and repeat the change of hands until the cord is long enough (Fig. 54, *b*). If only two twists are used, it is well to

keep the hands as far away from each other as possible, while twisting not more than 2 inches of raffia in each. This will tighten the rope and the prettier will be the result. If three twists are required, the two hands, while twisting each end tightly, should be kept as close together as possible; this will help to allow the necessary room for the third twist to be pressed into its place as it goes along the path it came. Fig. 54, *c*, shows the method of arranging the work and bringing back one end to form a third twist. Children enjoy making raffia handles for baskets, or ropes for reins, etc. They are much mystified by the fact that the twist does not unwind.

To finish off a handle made of two twists (Fig. 54, *d*). In making handles, it must be remembered that the raffia used should be somewhat longer (say 4 or 5 inches) than twice the length of the handle required. To finish the handle, tie the two ends firmly together as at A (Fig. 54, *d*), twist both separately for about 1½ inches, then tie each, and turn them up so as to form a loop which can be sewn to the inside of the basket. If the short ends left (B in Fig. 54, *d*) are spread out and turned back down between the loop and the basket, they can be cut off when the handle is in place.

Through twisting raffia, children understand better the meaning of the words, two-ply wool, three-ply, etc. Children enjoy making raffia rope, and very often do it just for the pleasure of doing it. It fascinates them to see how the third twist stays in its place and almost seems to find its way back of itself.

Children will be amused and interested at the picture of the ancient Egyptian making twine (Fig. 55). He is twirling a spindle in the air which twists a long length of "grass" of some kind, perhaps fibres of flax, which passes from a basket (or what looks like a basket, it may be a roll of fibres) over a forked branch to the spindle.

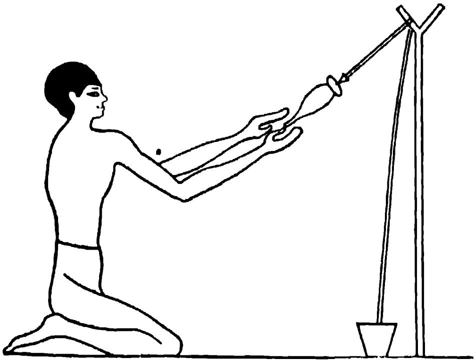
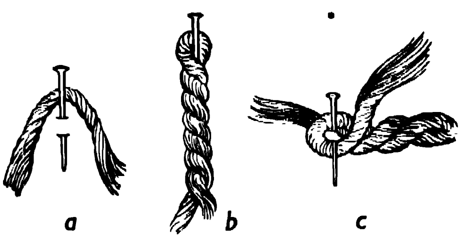


Fig. 55.—Ancient Egyptian Twine-maker.

Dyeing

To complete the story of the fleece the children should know something about how the wool gets its lovely colours. The step in dyeing that is most fun and is of most educational value to children is hunting among common things of one's acquaintance for possible dyestuffs. Children will probably think first of things they have spilled on the tablecloth that have stained it. Next they will think of brightly coloured things such as—beets, carrots, ink, and so on. Some of the things they suggest



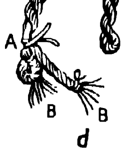


Fig. 54.—Raffia Twisting.

will, of course, sound foolish. The second step in the process of dyeing is in some way to get the colour out of the dyestuff. Boiling or long soaking generally does this most effectively.

Collecting Nature Material

The use of vegetable dyes will introduce children to soft, harmonious colours. Chemical dyes (aniline dyes) tend to be crude, although today really clever chemists can make lovely colours from coal-tar. (The children will probably learn about the by-products of coal in the geography lesson: see *Projects for the Junior School,* Harrap.)

A country walk becomes of added interest when it is of the nature of an exploration, a looking for something. As far as possible, children should be allowed to collect their own materials. Many will go by the colours of flowers. Yellow dandelions must produce *yellow,* blackberries *black,* and so on. They need some guidance. Collecting plants for the purpose of extracting dyes from them might well form part of the Nature Study lessons. Let the children collect roots in autumn, leaves when only *just* fully grown, and lichens in winter. Seeds, berries, and nuts are picked when they are ripe.

Having found a material that gives up its "colour," the next step is to prepare the wool to take the dye. Children do *not* realize that it is no use colouring wool unless the colour is permanent. It must not wash out or fade away in sunlight.

Making the Colour Fast

This means the use of a *mordant.* A mordant is a chemical in which the wool is boiled (usually before dyeing) in order to prepare the fibre to receive the colour and to fix it. *Alum* (potash alum) is a good ordinary mordant. About one pound is needed to four pounds of wool. *Chrome* (bicarbonate of potash) is especially good for wool, and is easy to use. It leaves the wool very soft. It should be used sparingly, about half an ounce to a pound of wool; too much will spoil the colour of the dye. *Iron* (ferrous sulphate) is mainly used to fix the colour after the material has been dyed. It has the effect of darkening some colours; chrome generally lightens a colour.

The process of dyeing is somewhat long. First there is time spent in getting the colour out of the dyestuff. How long the materials should be boiled depends on how soon they give up their colour. A note should be made of this. How much dyeing material goes into the pot is not of great importance; if the dye is too strong, it can be diluted; if it is not strong enough, more material can be used; for example, for walnut shells try three or four handfuls, then more if necessary. For well-chosen materials half an hour's boiling is generally sufficient. Notes should be made of the quantity of material used and the time of boiling. Then the wool has to simmer at least three-quarters of an hour in the mordant and later in the dye.

The following materials have been looked for and experimented with successfully by children. Those marked with an asterisk were the children's suggestions, the others were suggested by teachers:

*Dandelion flowers,** light yellow. *St. John's wort;* gather the stems, leaves, and flowers; these give a pleasing yellow. *Onion skins,* a useful bright yellow. *Crottle,* a lichen that grows on

trees and rocks; gather the old lichen, grey and black. From this lichen and other lichens various shades of yellow and brown can be obtained. From old lichen a rich, dark brown can be obtained, and also purple. Dyes made from crottle are much used in the home-spun wool of Scotland, especially in the north. *Walnut shells** and hickory nuts give fawns and brown. *Privet leaves,** yellow. *Blackberries,** dark red. The *bark** of different trees. Other materials that children have experimented with are coffee berries and tea leaves, dock roots, dandelion roots (which give a kind of magenta), red currants, pear and plum leaves (yellow). Iron rust provides an agreeable yellow, and it is not hard to obtain. Bits of old iron left standing in water will manufacture it. Elderberries, which give a dull violet colour. The children may notice in their experiments that it is difficult to get red or blue from nature material found in our country. They will be much interested if they are allowed to dye with indigo or cochineal. Indigo needs no mordant. It will give all shades of blue. It can be superimposed on other colours, thus giving a wide range of greens, purples, and grey.

In work like this, note-taking, " real note-taking," is essential and a motive for good writing and spelling. Lists of the plants or parts of the plant experimented with should be kept.

Here are some records of children of eight: " We soaked a piece of cloth in alum-water all night. The next day we put four handfuls of walnut shells in a gallon of water. We boiled it until the water became brown. We took out the walnuts. We put our piece of cloth while it was wet in the dye."

" My Experiment

" I chopped up some red cabbage. I put it in a quart of water. I boiled it for half an hour. I took the cabbage out. I put half an ounce of alum in the water. I wet my wool and put it in the dye. I boiled it for half an hour. Then I wrung it out and hung it up to dry. Then I washed it. It was blue! "

It was the alum that effected the colour. Some children may like to try this experiment and see if it is really true.

The value of a school museum in connection with these experiments is obvious. Samples of the mordants used and the liquid dyes made can be put in small labelled bottles for the museum. Samples of the dyed cloth should be mounted on sheets of cardboard, and the recipe written on the back. One can imagine the joy the children have in building up such a museum. The little bottles of dye especially interest them.

Again, if possible, the children should be taken to a school of weaving and see some experts dyeing.

In one Junior School, a frieze was made telling the story of a woollen jersey. It consisted of ten sheets of brown paper hinged together to make a panorama book which could be folded up, or pinned up on the wall as a frieze. Twenty children were responsible for it, two children to each sheet. On each sheet were pasted pictures, or drawings and paintings, short descriptions and sentences, etc., telling about each of the following stages in the story of a woollen jersey: (1) Sheep in a field eating grass. Written work, names of places in Britain where many sheep are found, etc. (2) Sheep being washed. (3) Sheep-shearing—pictures of sheep-shearing cut from a magazine, also a picture of a

"fleece." (4) Scouring the fleece; from this sheet onward, the drawings showed the children themselves as chief actors. (5) Teasing the fleece. (6) Oiling and carding. (7) Spinning. (8) Dyeing. (9) Washing. (10) Knitting or weaving the jersey. As the children had never made a jersey, they filled the last sheet with pictures of woollen cardigans and jerseys of different kinds.

It is well for children to realize all the work that lies behind the things they wear, or use, or eat. Their own experiments, incomplete and crude as they are, will help them. The value of allowing children at every age to suggest and to carry out their suggestions cannot be overestimated; for it is experience that really convinces and teaches, and that ought to convince and teach.

Another point that needs emphasis, especially with older children, is that a thinker is a worker—to think is to work. Children dimly begin to realize this as they follow the story of an invention, as they see new tools and wonderful machines take the place of old. They themselves may have felt a thrill over their own little inventions. It is a great lesson for them (when they are old enough) to visit a modern factory with its huge, wonderful machinery, that seems almost alive and that does accurately and well the work of hundreds of men—and then look back at the first simple spindle or loom. It was the *thinkers* who made these almost miraculous changes.

Back of the motor's humming,
Back of the belts that sing,
Back of the hammers drumming,
Back of the cranes that swing,
There is the eye that scans them,
Watching through stress and strain,
There is the Mind which plans them—
Back of the brawn, the Brain!

(From "The Thinker," Berton Braley.)

CLAY MODELLING AND CARVING

CHAPTER ONE

THE VALUE OF CLAYWORK IN THE PRIMARY SCHOOL

The Needs of the Child

WHY teach handcrafts at all in Primary Schools? Does not free painting and pattern work do all we can hope to do for the child with less material difficulties and less wear and tear on everyone's patience?

While all of us, not least the craftsman, think painting is so essential that its importance can hardly be exaggerated, we need handcraft—or, as it is better to call it in the earlier years—play with materials. It is needed firstly to give the child the widest, fullest contact with the physical world that he may *take in* to himself something of the varied and individual nature of its substances; and secondly that he may *give out* in the widest range of appropriate forms. It is as though we must equip him with a language to express himself and convey his meaning—or at least we must give him not only colours with which to speak, but solids and textures, the raw materials from which to build his language. Paints are used on a flat surface in two dimensions, but he also needs materials with which to build solid shapes in three dimensions. Then, in painting, we translate the appearance of texture into brush-strokes—representing a shiny surface with streaks of varied colour, and fur with rough brushwork, and so on. But the child needs also to handle and build with actual textures, to contrast fur with silk, the smoothness of metal with the roughness of stone, and to combine these pleasantly as he would combine colours in a picture. Some children will prefer to use paint for what they want to say, some wood, some scraps of cloth, but they must have experience in handling all kinds of materials and creating with them. The foundations of a sound and interesting taste in clothes and furnishings in later life can be laid through this familiarity with materials in the Primary School.

The Taking In

The early years are the exploratory period, when the child is becoming familiar with the feeling of things and the emotions they arouse. So these young things need a wide variety of materials to play with. They need at first not teaching, but leaving alone

with the right things—not just the carefully adult-selected apparatus of Montessori, but the raw materials of our earth. How delightful to spend whole lessons simply in handling, smelling, comparing, and trying out different substances, to know no one will think it a waste of time if nothing tangible is produced. Waste of time? Surely the widening experience—interest, the growing confidence that comes from the knowledge that wood or brick will do what clay will not—is an end sufficient in itself. Thus the characteristics of wood are that it is fairly hard, can be cut along the grain with a knife but across the grain it must be sawn or hacked; whereas clay is soft, yields to the pressure of the fingers, but becomes quite hard with great heat. This intimate knowledge of the native qualities of materials is picked up almost unconsciously when they are constantly used in play and construction. Materials are found to have different characters as people have different characters, and must be treated differently; but it is the very basis of that subtle relationship between man and material which is the core of craftsmanship in later life.

Not that childhood should be subordinated to adulthood. Each has its own validity, each its own experiences, both are only stages in the development of the rounded human being. But children who have had these opportunities are potential craftsmen, whereas those who have not can only go back and try to capture this unconscious absorption, hampered by the developing self-consciousness of adolescence. If only one could presume those opportunities in the home and the nursery of pre-school years, there would be less need to stress them in the Primary Schools, but, in fact, one suspects this stage lasts longer than is allowed for—perhaps it is never fully outgrown.

If a number of these materials are provided in boxes and bins around the classroom, the child can be left to linger over them, getting to know them in this way. He will be found to take up pieces of wood and stroke them first along the grain, then crosswise; to plunge his hands into a bin of soft clay and squeeze it through his fingers repeatedly, perhaps press the lumps together and pat them into a ball, then drop that and plunge his hands up and down again. All this is a good and necessary part of his education. It is the preliminary stage to making, and cannot be missed out if later the material is to feel friendly and familiar to work with. In the first few years of the Primary School, at least, the children need not be hurried or urged to make something if they show a desire to linger over the handling and feeling stage.

It may be that in the early years experience is so new that an action must be repeated constantly to be fully comprehended and enjoyed, as singing games and nursery rhymes are repeated. The ideal is to let the child remain at one thing as long as he will. Our very enthusiasm about the riches around may lead us into hurrying him from one experience to another. So do not worry if the children *produce* little, the experience is not lost. It *does* crystallize at a later stage when the mastery of technique has enabled the older child to form something which is both satisfying in the making and permanent. Education is not to be measured in terms of the things pro-

duced. It is the effect on the children, and not the things produced, that we are concerned with.

I have been trying to describe the taking in, the enriching of the child through acquaintance with his environment. There is also the giving out.

The Giving Out

Why do children want to talk? To draw and paint? To make things? These activities seem to spring from many sources—the need for the expression of thoughts, and of problems, the desire to communicate, the instinct to construct, the need for symbols to crystallize and redirect the forces of the unconscious.

This last is the most difficult to describe briefly, but it is such an important function that it cannot be ignored. It is generally recognized that children have all sorts of fears which may not seem rational to us. Perhaps it is fear of dark stairs, of some imaginary animal, or fear of their own impulses to steal or to hurt. This is not a morbid condition until it seriously disturbs the child's behaviour. All children suffer from such fears to some extent. What is not so generally realized is that it is the covering up, the smothering of such fears (and perhaps hopes) which does harm. If the child can talk about such things and find sympathetic help, he will more easily outgrow them. Where a child will not or cannot talk, he will often have an urge to draw or to model what is worrying him. If he can put down on paper or clay the beast he fears, or draw the catastrophe he dreads, then he is in control of it, he has conquered it to some extent just by making it explicit. Now it is a thing existing on paper before him, and he can laugh at it or perhaps tear it up and so destroy it. This is not a far-fetched or fanciful interpretation of events. It has been abundantly proved.

That such phantasies, as they are called, need to be expressed and thereby lose much of their terror has been shown repeatedly, and clay is the ideal material for their shaping. This can be seen as one of the chief functions of claywork. The teacher is not expected to be a psychologist, or necessarily to interpret such phantasies. Her job is to provide the materials and opportunity and to create the atmosphere in which the child is not afraid to reveal his innermost thoughts. It may help a great deal to listen sympathetically if explanation or description is vouchsafed, but, above all, never to show shame or ridicule. If the child is pondering over a problem in his own mind, to bring it out and air it is the first step in the right direction.

Three Ways of Giving Out

The child need not be urged to finish his work to a stage which seems complete to our adult mind. If it answers an imaginative or a practical need, that is enough. By answering an imaginative need is meant providing an opportunity and a material for the expression of what is in the child's mind; not only the fears just described, but also the hopes, as when a little girl models herself a baby like mummy's or a boy models a boat and puts himself in it rowing. Then there are all the more fantastic creations of the mind, dragons, and queer animals which have to have special names made up for them, and witches and goblins. At this stage the child is exploring all the

country of the imagination, all the creations of his fancy, as our early forefathers did and all primitive folk do, in making up fairy-tales, ballads, and mime-dances. The inhabitants, beasts and men, of this country are as real as or sometimes more real than those of the outside world. This is to be encouraged through all the Primary years, because it gives every child a wider stock of experience — imaginative experience — than it could gain in its restricted life, and because it is largely from children whose minds have been encouraged to rove in this way that the poets and the artists come in later years. Just as the young limbs must have untrammelled freedom to exercise, to range as unconfined as possible, so must the imagination.

It was pointed out that the child's work might serve an imaginative or a practical need. Now a child of six or eight can knock together something of wood and nails which will run as a trolley, or stitch a real kettle-holder or belt. But he cannot make anything of clay which will genuinely serve as a teapot or plate. He has not got the technique, and without a great deal of adult help he cannot fire it or make it permanent and waterproof. So it must be accepted that clay is primarily a material for imaginative expression in the Primary School. The imaginative and the actual worlds meet in the world of play. Though the child cannot make real cups and plates, he can and should use clay to model such things when he needs them for his games, and this will lead on to Senior School pottery. The demand for such things as teapots and pans will arise naturally out of play activities, and the child will tackle them with all the urgency of his present need. If he sees an immediate use for cups and plates, he will be eager to make them, so there is no point in devoting whole lessons to the modelling of such articles unless it is for a project on which the child is already engaged. This will be considered in detail later, when talking of claywork allied to other lessons.

So there are three ways in which clay can be used. Because of its plastic nature and solid form, it is a material in which the child can express his imaginative side. For the same reasons, it can be used to form many of the objects or utensils for play, and this leads on to the more practical functional work of ages 10–11, when the child will be trying to form jars and bowls and tiles for real use. Then, lastly, there is claywork used to illustrate other subjects. For all these purposes there is no other material which offers quite the advantages of clay.

Clay—or Substitutes?

It has been the custom to use substitutes in the Primary School for these purposes, though usually in a rather unimaginative and stereotyped way. Now these have one apparent advantage over clay in that teachers think they are easier to keep and store. But once the principles of managing clay have been grasped, it is not difficult to keep. And substitutes have two great practical disadvantages: firstly, they are too expensive to use in the large quantities which young children need—they should have handfuls to experiment with. Secondly, they are often dirtier than clay. Clay will brush off the clothes when dry, and wipe off tables and walls when wet. To most people, clay is much pleasanter to handle; it has, too, a great educational

advantage—it is one of the basic materials of our whole civilization. The children can see it in its natural state in the earth, and relate it to different types of farming land. They can go on from the play stage of forming toy mugs and plates, almost without noticing, to the stage of making their first real mug, using their experience of the material to help them at this later stage. Clay is a handcraft material suitable for every age, and, given that freedom from direction which is desirable, every age can use it in the way appropriate to satisfy its own needs. So we avoid the multiplicity of different materials in the schools. It is now being realized that it is better to have a few basic substances—wood, clay, wool, and cloth scraps—rather than a multitude of ready-prepared materials, such, for example, as a ready-cut wood base, measured withies, and beads for the making of a tray according to recipe. Such manufactured constituents leave the child only a few mechanical processes, and the nature of the finished article has already been determined by some adult. We do not want such predetermined products. If the child is presented with ready-made pieces of set shape and size, how will he ever learn to cut and shape for himself the parts demanded by the thing he has a real urge to make? It is just because the shapes and forms of clay are infinite that it is such a valuable material for all ages.

The Necessity for Direct Work

One educational advantage of clay is that it increases the range of legitimate ways of tackling a job. Clay is essentially a material for *direct* work. It is the intimate pressure of the fingers, the push and thrust of the arm, which form it. Its inspiration is in sensation rather than thought. So the children need to be encouraged to work fairly quickly, both for this reason and because clay pawed in hot palms for a time dries and is no longer plastic. When the subject is first introduced, quick studies completed, considered, and squeezed up at the end of the lesson are the most appropriate form of claywork. This will introduce the direct attitude to the material which may be quite new to the children. In other subjects they have learned to go over and over their work, checking and trying to improve it. At this age there is no place for that in claywork. To work quickly, surely, discard the unsatisfactory, and begin again with a new piece is much better. This attitude may be built up through painting in days of unlimited paper, but since clay is cheap and generally plentiful, the children can feel they can use as many lumps as they need. The discipline of the craft comes later, but in the Primary School we can plant the beginnings of that attitude to the search for a form which will truly represent the idea in the child's mind and encourage him to make repeatedly a fresh direct attempt at the same subject.

The Value of Claywork for Child and Teacher

So we can sum up the value of claywork in schools for the child and for the teacher. For the child it provides a new field for his sense education, being a three-dimensional material to be formed in the round and known through the sense of touch. It exercises the fingers, and demands control and discrimination in the service of the child's own wish to form. Because it is so easy to model and mould, even by

the youngest child, it is a material in which his imaginative side can find expression; and since there are few limits to the forms it will take in quick response to the fingers, it does not inhibit this expression as a harder material does. This is its greatest advantage and the chief reason why every child should have the opportunity of using it. Then, in addition, it can be destroyed if the result is unsatisfactory, without the responsibility of being destructive, or it can be made hard and permanent.

From the teacher's angle it provides the ideal material for what is called "expression work." Being plastic, it has many uses in projects, can be combined with other materials and provides links with many other subjects. From the very practical point of view it is cheap, can be used over and over again, and in days of all sorts of shortages is always available, if one knows where to ask for it.

CHAPTER TWO

CLAY

Local Affinities

IT is being realized more and more widely that the school should be an integral part of the community, both because each has much to give the other and because it prevents that dichotomy in the child's life which leads to such difficulties. So, if one is fortunate enough to teach in a school in the country, crafts can be linked naturally with the life of the country around. In some districts the most appropriate material to specialize in would be wool, and in some clay, but it is important for every child to have the chance of expressing himself in three dimensions. If yours is not a clay district, and you have to order it from some distance, there may still be some quite small area of clay soil on a river bank or in a hollow where the children see it actually in the ground, and see what plants grow on it, and how the footprints of animals are imprinted there, which is a link with their finger-pressing and scratched decoration.

In Clay-soil Districts

If the school is in a district with "heavy" agricultural land, with pollarded willows along the banks of mud-coloured rivers, then the chances are that you will find clay without much difficulty. When the children have handled the clay in school, they will understand why the plough moves slowly through such soil and why the farmer cannot plough as soon after a wet winter as he can in light, sandy soil. It can be pointed out to the children that the architecture of a district used to be an indication of its soil. In the sandstone and the granite districts, the building material was at hand and just needed to be quarried and trimmed. Where much wood was available, houses were built of timber; for example, the Anglo-Saxons often built their homes in forest clearings, using split trunks of oaks set vertically side by side (see HISTORY, Chart IX); in clay districts the early Britons built their homes of wattle and daub, that is, woven branches plastered with mud or clay (see HISTORY, Chart IX). In later times, houses were built of bricks in districts where there was clay. There were few brick houses in London before the Great Fire of London, 1666. Previous to that time they were built of timber and lath and plaster. There is much clay around London, hence the many brick houses today. The children should notice whether their houses are built of clay, stone, cement, etc.

The material in its turn had its effect on the shape and details of the house. But as transport has improved, it has been found cheaper to bring building materials from a centre where they can be mass produced than to make or quarry them locally, and this has done much to obliterate the individual

character of different districts. But the soil is of great importance in determining the type of farming, mining, or industry of the district, and thus determines the character of the community. If the district has clay and clay industries, the foundation for a school craft is all around. It is infinitely better to use local clay, if it is at all suitable, because the children will be familiar with the other uses—as bricks, tiles, or pottery, and because it will simplify very much all the problems of supplies and firing. If it is feasible to co-operate with one of these industries, a visit to the local pottery, whether in the country or town, would be the best possible introduction to your clay work. If the local pottery or tile works will supply you with clay, it will be already sieved and pugged—that is, worked with a kneading movement till it is very plastic—which will save the teacher's energy, and the children's. But an excursion to explore the local clay pits and see it in and out of the ground, and possibly to trace the route by which it arrived there, would always be of interest.

In this connection it is interesting to make an excursion up the local river, taking samples of the soil from the bank and helping the children to discover how one can tell the clay patches by the type of vegetation. When samples of clay have been compared for their plastic qualities, by fingering and pressing them, small rings of the various sorts can be fired in one of the primitive ways described in Chapter VII.

The suitability of clay for use depends chiefly on how easily it can be shaped and how well it fires. If we are going to use any material in education, we want to know something about it before it arrives at the door. Most of the craft materials link up in a most interesting way with geography and natural history. This is partly why it is important to use local natural materials. Then, too, the children see education as a whole instead of cut up into arbitrary periods of thirty-five minutes divided by a bell.

The children will feel more familiar with the clay used in handwork if they have learned in geography how it is laid down, why it may be too gritty to use, and why it is so coloured. Their work may be in a small way the continuation of that of the old builders of our town who roofed the houses with red tiles. A drain-tile works (drain tiles are the heavy pipes used to carry away water from cultivated land) in the neighbourhood may supply us not only with clay but with links with the agriculture and forestry.

Districts without Clay

There are very few districts where there is no clay of any sort. If there is some which is too sandy and not sufficiently plastic for pottery, it can be used for tiles. If there is none at all, it will have to be ordered from some distance, but Staffordshire is no longer the great clay-producing county of England, and it is not necessary to send there if it is a considerable distance away. The great pottery industry continues to be centred there, as the factories are there and the coal is there, but the bulk of the clay is imported from other counties. There are hardly any counties in Britain which do not have some clay, and since the cost of transport is usually the largest item, it is logical to get it as near at hand as possible. If you can visit the tile works or

pit from which you propose to order it, there will be the opportunity of handling the clay in its raw state to see whether it is plastic to work, to see what can be made out of it, and to see the colour and texture of the fired clay.

What are Clays?

Clay is a product of the breaking down of feldspathic rocks, which are known as the mother rock of clay. The hard granites which are found in this island decompose naturally into clays, and these are washed down by streams to settle in the valleys. The clays dug up are made up of chemically pure clay and the impurities picked up on the way, so that they vary chemically, that is in composition, and physically, that is in condition. On these two things depend their three properties of plasticity, porosity, and fusibility. Very plastic clay is gelatinous, which seems to be due to the shape and relationship of the grains of clay acted on by water. It can be easily shaped and coheres when pressed together, but it is too dense to let the water inside escape when it is fired. Porosity is due to the admixture of sand, coarse or fine. Coarse sand opens up the pores, making the clay easy to dry and fire, but reduces its plastic qualities to some extent.

The fusible clays are those which lose their shape at under 1200° C. and the presence of vegetable potashes lowers the melting-point. The refractory clays are those that withstand heat and do not liquefy at about 1500° C.

China clay or kaolin contains a high proportion of chemically pure clay, is very white and is found in large deposits near its mother rock chiefly in Cornwall. It is not very plastic and stands up to high temperatures. Secondary clays are those which have been carried farther from their source, have on the way gathered a wide variety of colouring oxides and decayed vegetable matter so that their composition is much more mixed and their colours and vitrification points (that is, the temperature at which they are converted by heat into a glass-like substance) vary greatly. Ball clays, for example, are very plastic and may be used for mixing with local sandy clays when doing work which requires more plastic material.

How Clays behave

When clay is dug up from the earth it is more or less plastic. Dry clay is simply a powder. It does not cohere. On the other hand, to stand plastic clay in water for a time causes the particles to fall apart altogether. Our job is to increase the plasticity by working it in the presence of water so long as we want to shape the clay. But when we have finished manipulating it and got to our finished form we want to drive off this water before we fire it.

Firing is not simply heating clay; it is heating it to such a temperature that it undergoes a chemical change and becomes another substance. When it is dry, unfired ("white clay," the potters call it), it holds its shape because the particles have been pressed firmly together, but it is very fragile, and a knock or jar will break it. Once it is fired, it is hard and resistant to any but violent usage. When we put the formed models or pots to dry, the air dries off the water which we mix with the clay or find mixed with it in the earth. The firing drives off the water which is chemically combined with the clay. This loss of water causes contrac-

tion up to as much as twenty per cent. To help this water to get easily out from the inside of the clay, it is good to have the plastic clay mixed with sand or with grog. Grog is fired clay which has then been pounded down to a coarse powder which gives the clay pores, so to speak, and reduces the shrinkage, but this reduces the plasticity of the clay, which does not matter so much in modelling but matters greatly in wheel-throwing. So one aspect has to be balanced against another. If the clay has naturally little sand, it is possible to add grog up to the point where it becomes too short—as short bread is short —to work.

If it is impossible to get a local material suitable for modelling, T material,* or preferably a mixture of this and a plastic clay, can be substituted.

It is better not to encourage young children to model very large solid forms which would have to be hollowed out from below to allow the moisture to escape. Once they have finished the outer form of the model to their satisfaction, the children need prodding to keep them at the hollowing out after their interest has faded. It is better to tell them that if they want to have the chance of having it fired it must not be thicker than three fingers—or whatever your clay will stand. Very gradual heating up in the firing will minimize cracks due to too thick a section.

* T material is the trade name for a mixture sold by the Treforest Trading Co., Ltd., Pontypridd, South Wales.

CHAPTER THREE

MODELLING

The Activity Period

MANY Primary Schools now have at least one activity period in the day, when the children are offered a free choice of different materials and can make what they want. Obviously, clay should be offered along with paint, carpentry tools, etc. (see Section on Free Activities). Children who have been brought up to this type of free activity fetch out their own materials, experiment with ways of using them, and generally behave in a responsible manner. But it is the teacher's responsibility to see that the materials are in fit condition to use.

In experiments with regard to children's choice of material carried out on a large scale in America (e.g. Louise Farwell), it was found that clay ranked high in favour, but some teachers in England have asserted that children do not often choose clay. It has frequently been found in these cases that the clay, though just plastic, was not really soft enough to be easily pressed and fingered. It has to be remembered that when it has been used and handled it is then drier and cracks easily. So, to begin with, it should actually be a little softer than is required. A well-fitting lid to the bin will ensure that it does not dry off overnight after being damped at the end of a school day.

Variations in Conditions

The conditions and possibilities in schools vary so much that it seems best to treat the subject in sections, so that any teacher can adopt and develop the type of claywork which seems possible in her circumstances. (Generally speaking, the pronoun " she " is used here for the teacher and "he" for the pupil, to avoid the clumsiness of always saying "his or her." These are, of course, interchangeable, and it is not necessary to make any difference in the work done with boys and girls, except in suggesting subjects appropriate to their interests.)

Do not think that in order to do claywork it is necessary to have elaborate equipment. Clay is probably the cheapest of all handcraft materials. In the early stages, the children need no tools, which is a great asset in organizing large classes. Start simply, and if you and the children find the subject fascinating, the scope of the work can expand gradually.

Modelling is an activity for every age, from the crawler to the adult, and it will be treated first. Children will play at making tiles and pots and cups and saucers for dolls from an early age, but we need not expect before nine or ten, the concentration and workmanship necessary to make a tile or a pot which will fire and is usable. Clay treated as part of a study of environ-

ment can begin about the same age (or younger if young children are working with older ones in a group activity). But the suggestions for various ages must not be taken rigidly. A child of seven may have a mental age of three and a half or ten and a half, with a similar range of emotional age, so it follows that we must expect a wide variation in any age group. These suggestions are intended for the teacher who might otherwise feel at sea with a new subject, and are starting-points from which to branch out into work suitable for the temperament of different children, the locality and its interests, and the enthusiasms of the teacher.

Generally speaking, the amount of equipment which it is profitable to have increases with the age of the child, but work can start at any age with a very small amount of bought equipment. Young children should not be provided with many pieces of new equipment at once.

But first a word about the messiness of clay, which is often a stumbling-block to its introduction into schools.

Mess

If the mess, which cannot altogether be avoided if the children are to have freedom to move about and really help in the preparation of the clay, is going to be so unpopular as to stifle the whole project, why not start this as a summer-term activity? Have lessons in the playground, keeping the bin of clay under a rough lean-to shelter, or even a tarpaulin. In the classroom a certain amount of mess cannot be avoided.

In introducing different types of work in the Primary School, we may have many aims in view, and we must face the fact that these specific aims of education may appear to conflict. In any one lesson we must have a dominant aim and make that clear to the children. If our object is neatness, cleanness, or precision, there is no place for claywork in that lesson. If we introduce clay, it is because we value freedom of expression, sensitivity, the development of a sense of form and touch. We must not present the child with two conflicting aims or allow two different ends of education to create a deadlock in one lesson. If the threat of dirt is held over the heads of the children all the time, they will be scared and inhibited, and this will undo all the good which the introduction of claywork can do.

If the room is on the ground floor and opens on to the playground, the clay can be kept just outside, protected from the weather. If not, stand it near the sink—one just hopes there is a sink. The children can each bring a newspaper and take out a sheet to cover the desk whenever claywork is done. The sheets are rolled at the end of the lesson, with the scraps inside, and put in the wastepaper basket which is passed round. This will go a long way towards keeping the mess within bounds; a stiff bristle mat at the door will collect the surplus clay from the bottom of shoes, and minimize tramping it round the corridors. Another solution to the problem of tramping clay dust around the school is to let the children wear gym shoes for this work, because rubber soles can be easily wiped with a damp cloth afterwards.

It is better to let them be thoroughly messy in old overalls and bare feet in summer, and all help in clearing up the mess afterwards, than to fuss all the

time, which destroys the atmosphere for work or play.

The Clay Corner

In the Infant School garden a clay-pit with board sides forms a good parallel to the sandpit which is by now generally accepted. Bare feet in summer and rubbers in the winter are indicated, and the most useful garments to play in are paddling pants of oiled silk or plastic, now worn at the seaside by children.

Children must be allowed to get dirty, and if there is one place where they are allowed freedom to get really messy they are much more, not less, likely to be reasonably clean when occasion demands it. This is a parallel to the fact that children who scream constantly while running about the streets are those who are kept unnaturally quiet at school or at home.

The children can be left absolutely free to make what use they like of the pit and not urged to make anything. This is part of that "taking in," that is, becoming familiar with the substances of the world around. If they do make anything, praise and interest will encourage them, even although the objects may be quite unrecognizable to us. In the Junior School this pit can be adapted as a "clay corner" in the playground or classroom. With small children a low bath with a fitted lid to hold the clay is better than a bin; this can be kept on a large slab of cement or plaster in one corner of the room. Since, presumably, only a few children at one time will choose to work with clay, its use can be limited to the corner. The ideal arrangement, indoors or out, is a cement well with sides three or four feet long, about six inches high, and from four to six inches broad. The corners should be rounded inside. A tap above and plug-hole below makes washing-out easier, but a damp cloth will serve.

The children will happily sit on or crouch round the edge of the well, and all the clay is kept inside it. Where it is proposed that whole classes will work with clay, other arrangements must be made.

Equipment for Modelling

The simplest possible equipment for doing claywork is:

Ready-pugged clay.
Barrel or bin with lid.
A waterproof cover.
A piece of wire.

The bin can be a galvanized coal-bin (which, being rectangular, may fit into your space better) or a dust-bin or barrel with lid. A dust-bin about 30 inches high will hold 2 cwt., which should serve a class of thirty for half a term if you do not intend to keep much work; but the amount depends so much on factors difficult to assess before you have experience. Better order too much clay and leave it outside to weather in a corner of the playground.

Providing your clay arrives pugged from a local source, you merely need to empty it into your bin and keep it plastic. Remember it must not get too

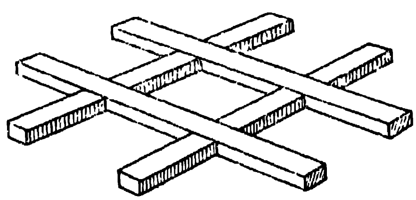


Fig. 1.—Wooden Stand to keep Clay out of the Water which collects inside the Clay-bin.

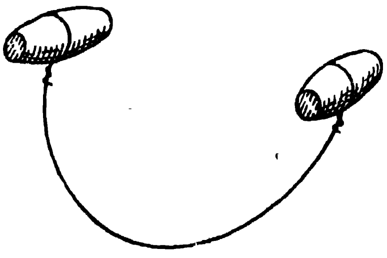


Fig. 2.—Wire Cutter.

wet or too dry. To prevent it from sitting in the pool of water that collects when it is damped from above, put a wooden pot stand in the bin, or knock up something similar from scrap wood, to lift the clay from off the bottom (Fig. 1). Two bricks with some slats of wood across will serve the same purpose, or an old grid or sheet of galvanized metal with holes knocked through *downwards*.

Take the clay out of the sack (because in the damp, enclosed atmosphere the sacking will disintegrate and annoying threads get embedded in the clay) and place the lump or lumps on the stand. Cover the whole with a piece of rubber sheeting or old waterproof. Cover that with a soaking-wet sack and the clay will keep for weeks. When you want to use the clay, you can cut it up into small lumps with a piece of wire (if you twist each end of the wire round a piece of scrap wood, you will have a wire cutter easier on the fingers (Fig. 2).

CARE OF CLAY

If the new clay arrives in such a hard, solid lump that it will not cut even with a wire, then put it in the bin, sprinkle on water at intervals, covering with a wet sack between sprinklings, and in a few days it should be possible to cut it. But if the clay has gone "white hard," as potters say, even though it is red or buff clay, that is, if scratching it with your nail produces a white dust instead of a little solid piece, then it must be made into a slip with plenty of water and put through a sieve and pugged, as I describe in Chapter V. If you order your clay from

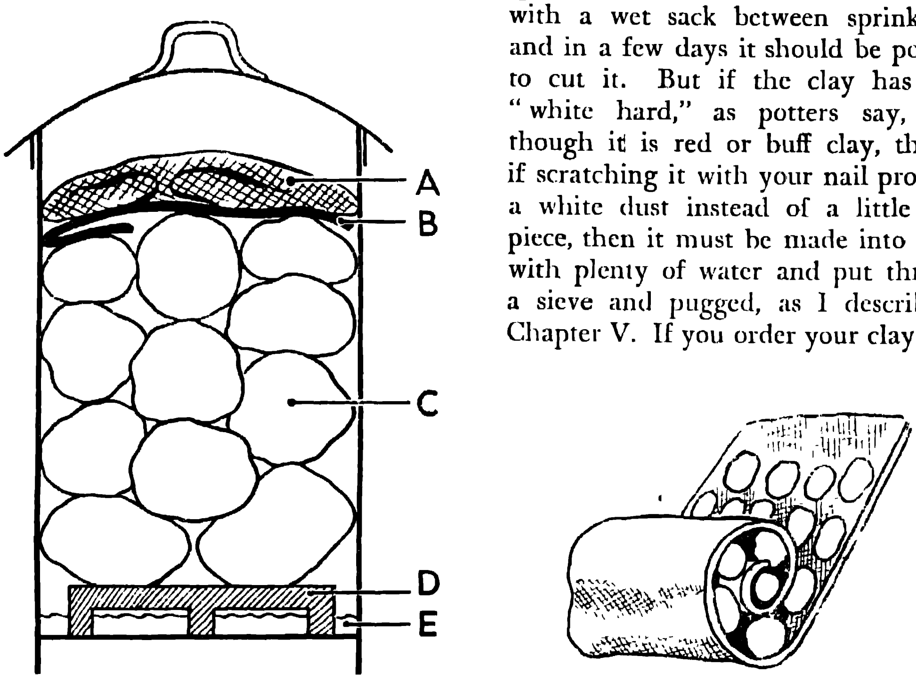


Fig. 3.—Clay of good consistency can be stored in Lumps, arranged as shown in the Bin (A) Soaking wet Sack. (B) Rubber Sheet. (C) Clay. (D) Pot Stand, and (E) Water that has dripped down. Clay that has become too dry must be softened in a Roly-poly of wet Sacking.

so far away that it goes quite hard on the journey, you will have all this work to resuscitate it, even though it has already been pugged; this is another reason for using local clay.

Do *not* buy your main supply in powdered clay. The only advantage is that the transport costs less, but you give yourself a great deal of work, and you do not get the clay into good condition for a long time. It is claimed that it is easier to store clay in the form of powder, but once the elementary principles of how to keep clay have been grasped, storing it is no problem. A large quantity can be heaped in the corner of the playground or a shallow pit, and taken up a day or two before it is needed, to damp in the bin or dry off on a table as it is required.

If the clay gets really hard and lumpy (e.g. after being left over a holiday), you can break it up into easy manageable pieces and make a "Roly-poly" in a really soaking sack, laying down the pieces of clay and rolling it up in the sack after every row (Fig. 3).

After about half an hour, this clay will be usable, and after a few hours go soft. If you keep your clay at the right state of plasticity, you will save valuable time and energy.

After working-time is over, each child can roll his used clay into a few small balls like fists, and these are dropped back into the bin. By now, the worked clay is hard and "short"—so layers of wet sacking can be put between to damp the clay again. It is useful to do this methodically, folding in the corners of the sack on top before spreading the next sack flat to receive the next layer of balls. Then next working day each

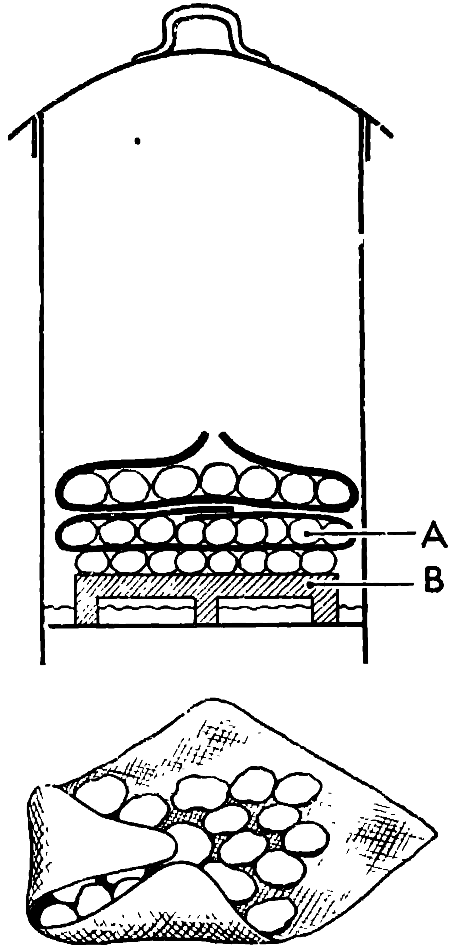


Fig. 4.—Storing Clay to keep it Plastic when in constant Use. (A) Layers of Sacking and Clay. (B) Pot Stand. Underneath, Balls of Clay are shown folded in a damp Sack.

sack can be lifted out by the corners on to a table, and several children at one time pick a ball or two—all of which saves time (Fig. 4).

Arrangement of Equipment in an Ordinary Classroom

Now how is it possible to keep the equipment in an ordinary classroom? The ideal is an old Army hut or shed out of doors, but we are working up

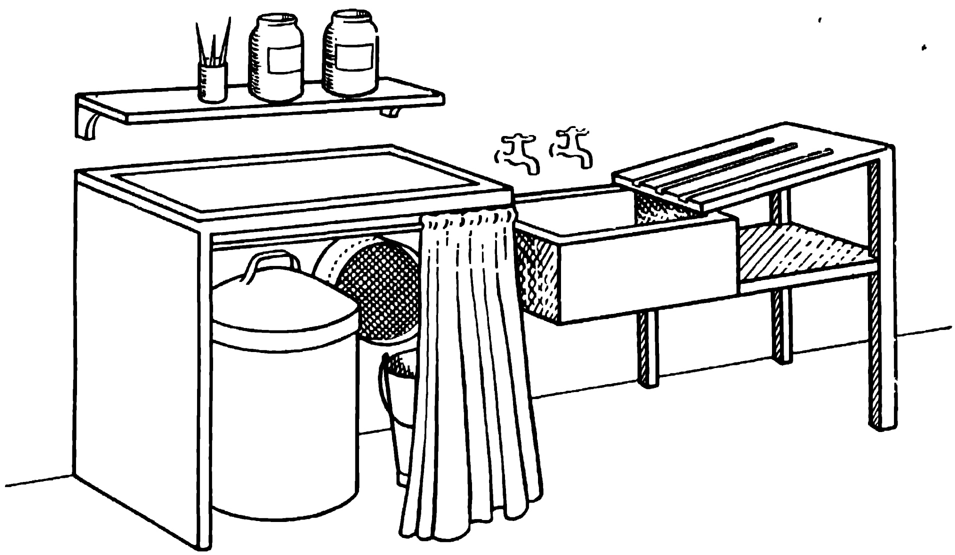


Fig. 5.—Arrangement of Equipment suggested for All-purposes Classroom.

towards the ideal, so let us consider the most difficult conditions first.

If there is no french window or outside door to the room, there may be a large cupboard where the bin and other equipment you require can be stored out of sight. Failing that, have a shelf made near the sink (if you have one) high enough to allow the lid of the bin underneath to open; or set the bin on a broken pair of roller skates, or a pair of bogie wheels, to push it in and out as required. In time you can cover this shelf with a brick or plaster slab as described in Chapter V. This arrangement takes up the least possible floor space (Fig. 5).

Additions to this Equipment

Children of all ages will model freely, and for this no more than the above minimum is absolutely necessary. But it is a great help to have boards for modelling on, because then the children can turn their models round as they work or carry them about. So this is the next piece of equipment to try to provide.

These boards may be, at a pinch, simply flat pieces of wood the children find and bring. If there are woodwork tools available, they can trim their boards; in any case, sandpaper will be useful to smooth the surface. These boards will also be useful when they start to make tiles and pots. For larger models to be fired it may be necessary to add grog to your clay, as described later. This may be obtained from a local pottery or ordered from Wengers, Stoke-on-Trent.

General Discussion of Subjects for Modelling

We said that there were three ways in which clay might be used: to express the imaginative side of the individual; to make objects and utensils for play, leading on to "real" pottery; and to illustrate other lessons.

In the earlier years our lesson-times can be devoted almost entirely to the first of these. These are the years which are so important for the development of imagination—I mean that freeing of the mind and spirit to explore without being tied down, as we all are later in life, to the practical necessity of *producing* the necessities of life or the wherewithal to buy them. Children need to explore physically, mentally, and emotionally. Physically, they discover that, for instance, if they press two fingers until they meet in a ball of clay the result is a hole in the clay; that if they press with a pencil-end on a lump, the result is a circular hollow; if with the point, it is a pointed hole. This is both felt with the senses and comprehended by the mind. These facts, which seem so obvious to us, have to be discovered by each one personally. Herein is the value of just letting them "play" with the material a great deal at first. All these things are becoming so familiar to them that later, when there is need, say, for an incised pattern, the child has in fact picked up quite a number of ways of incising and knows what the effect of each will be.

He needs also to explore emotionally. The child who modelled the "cat and kittens" in Plate I was not only remembering what a cat fondling her kittens *looked like,* but entering into the feeling, the tenderness, himself. Similarly, a child who chooses to model a tiger and paint on the stripes probably feels the fierceness of the tiger. And, in reverse, the child who is feeling fierce one day may harmlessly work off his feelings by modelling a wild animal. Here is a good reason for leaving the choice of subject very often to the children, or allowing them to select the subject. Thus they could choose the cat when they are feeling tender and the tiger when they are feeling fierce, and identify themselves with each. This "identification" takes place to a great extent with grown-ups, and especially with the parents. Most children spend a considerable part of their play in imitating grown-ups and entering into the feelings of mother nursing the baby, father going self-importantly to work, teacher scolding the class. And all this is a preparation for adulthood not to be hurried over. So if actual pots and pans, loaves and cakes are not available, clay should be at hand for making substitutes. But such claywork must answer the child's own needs at that moment. I see no point in making the whole class model a set of pots and pans on any particular day. These playthings are not made for their own value. A clay pan is neither truly useful nor beautiful—nor will the making of it give the child any new imaginative or emotional experience except of a very limited nature. These are made for an end outside themselves, for the purpose of the game for which they are needed. They are only made with interest and enthusiasm when that end is seen, when the child has reached the point at which he says "I want a so-and-so," and makes it. If we keep this fairly clear distinction of subjects for modelling before us, those which are truly "imaginative" in the sense of exploring, those which are "utilitarian" in the sense of making something wanted for the game in hand—perhaps a cake to sell in the shop in the corner of the classroom, or a teapot for a tea-party—then we shall be more clear about which is the most

desirable subject to suggest for the modelling class. To the last group belong teacups and saucers, models of joints of meat, of jugs, of a baby's cradle, and so on. These are legitimate subjects where they are called for by some project in hand. To the first group belong animals (not just seen, but also felt), characters such as the old men and clowns (Plate II), purely imaginary creatures, because all these give an extension of the child's experience. These are the subjects which are perhaps most rewarding and those which clay can most adequately convey. There are many other subjects which might be thought to be close to the first class, and of which prototypes exist in the world, which children are often asked to model—flowers, fruit, and vegetables. This is surely on the level of the purely naturalistic painting which is so pointless with children of this age; or worse still, if the vegetables are there to look at, it is on the level of pure copying. It fulfils none of those conditions with which we started. It does not encourage or exercise the imagination. It lacks the motive force of "making" in the service of a game. Some of these objects may, in fact, be used in clay to illustrate other lessons, but if so, this should be clearly appreciated.

It is quite conceivable that the teacher having taken a class of seven- or eight-year-olds for a nature walk and let them pick up and handle acorns, oak-apples, beechnuts, etc., should wish the different shapes to be impressed on their minds. She therefore lets the children model them in clay, so that the acorn can be fitted into its cup, and the four sides of the beech mast closed. This is a legitimate use of clay in the service of nature study, and is part of the Nature Study lesson. It is not necessarily art nor craft, and should not be called by these names, nor substituted for truly creative work. The question we must ask ourselves always is "Why have art and crafts been put on the time-table, and how can we best use the time to fulfil that purpose?" It was only when the need for encouraging the creative, the emotional, and imaginative sides of child nature were realized that these subjects were included. In so far as the time-table is divided into lessons at all, the art and craft time should be devoted primarily to those purposes, and the teacher must guard against the temptation to use that time only to reinforce her other teaching. But there are many subjects which, in the hands of a thoughtful teacher, can be inspired by other lessons, but which yet give each child the freedom to follow his own enthusiasms. Such a subject would be a market scene, possibly a mediæval market fair, familiar through history lessons, or possibly the local cattle or fruit market. Whereas a whole class asked to model fruit or vegetables will probably be bored, in the market subject each can choose those aspects which interest him (and some may choose vegetable-stalls). The arrangement of the scene, the introduction of appropriate figures—barrows, stalls, and so on—will give the *possibility* of creating a work of art. Other subjects that give freedom and choice of arrangement and may be called creative are: the railway station, the farm, the circus, the harbour, the fair, etc. Here the children may be reliving an experience (a real visit or the description of one), and the units of their whole scheme do, in fact, exist and may presumably bear some resemblance to the

originals; but if the children are not forced to model one particular station or farm, then they do have scope to plan the arrangement of the whole, to say where the people should stand, and so on; to group, consider, and regroup—in fact, to design.

We have to make a distinction, too, between using the craft lesson to illustrate history, and making coiled-pots or thumb-pressed pots by *methods* which were used historically, and possibly telling the children or showing them pictures of the use of those methods in other communities, to link up their work with early potters. Almost all hand methods of pottery are historic, but the distinction comes in *what* we expect them to produce by those methods.

If we say, " Now we shall each make a Roman vase as the Romans made them," we teachers are setting not only the method but the shape, the essentials of mechanism, the appearance and feel of the finished object. That is reproduction—in this case history. If we say, " We shall all make a coiled-pot "—with or without having talked about or shown historic examples—then the child is free to choose the size, the shape, the method of closing the coils, whether it will have handles or decoration, and so on. This is craft, creation in the material clay.

Different Emphasis in Different Lessons

It has been wisely said that in Primary education there should be no " subjects," and the increasing use of activity methods and the project system does a good deal to break down the arbitrary divisions which are so unreal to a child. But there must still be a difference of emphasis. If we are trying to educate the whole child, we have to draw out in turn his intellect, his emotions, his perceptions. Some activities will use one of those several aspects more than others. Some lessons are designed to develop the intellect, some to train the memory, some to train the body. Subjects designed to exercise the imagination and give coherent form to the emotions are just as important if a balanced personality is to result. If freedom of emotional expression, if the assertion of the value of the individual contribution, if the colour and grace of life are not found in the time given to dance, drama, and story-telling, to art and craft, where will they be found? We must guard jealously the times and the subjects when those are uppermost, and not let them be dominated by the values of reason and intellect, which are *equally* valid for the human being, but not *more* valid.

This provision for the emotional life will not encourage strong, undisciplined emotions as might be feared. On the contrary, making with actual materials is perhaps the soundest form of discipline to which we can introduce a child—and such an introduction and such a training he must have if the self-centred and dependent baby is to become a social human being. Materials exert their own discipline. Their nature is constant (not variable like even the best of human beings). They have their possibilities and their limitations, which have to be respected, or the object will fall apart or fail to function. In addition, the goal is a tangible one, not a dimly imagined standard of perfection. If the child fails to achieve it, he sees his lack and feels his want. If he, respecting its nature, does mould

the material to his will, then he has tangible proof of his success and the pride and lasting satisfaction of having made a *thing*.

Introducing Modelling to the Class

Since modelling is an activity almost as spontaneous as painting, the young child with a claypit at his disposal will not ask for subjects, he will simply pick up a lump of clay and begin to model. If the school is run on activity lines, the handcraft period will be very like the "playtime," and no child will be using clay who has not chosen to do so at that time. In that case a word of suggestion to anyone who looks hesitant and uncertain about what interests that particular child will be enough. The activity should arise spontaneously from the children's interests at the moment. The essentials of this method can be preserved to a great extent right through the Primary years, by the provision of *several* materials and by discussing subjects with the children and working from *their* interests. But even though one plans in the future to provide different materials in one lesson, it is often wise to introduce a new material such as clay with a few class lessons.

The more rigid class formation in other lessons, the more is there need for freedom in those lessons where it is desirable. So the whole class may move out of doors, as suggested, or friends may gather round tables or groups of desks pulled together, to see and discuss each other's work in progress. But, of course, equipment and materials must be accessible, and a child should be allowed to come and fetch additional clay when he needs it.

Subjects for Modelling

As was said, the preliminary to modelling is playing with the material, and if it is feasible, the clay should be divided up among as many containers as are available—bin, pails, tub—and set about the room where the children can gather round and plunge their hands in and squeeze to their hearts' content. This is suggested for the first lesson, but if in later lessons children come to the bin and just feel and handle the clay, they should not be discouraged. In the next lesson each child can be given a lump of clay, either by coming in turn to the bin, or by trundling that round as suggested. With papers over the desks, they can then build up their model in the hand or on the desk or on the boards, if provided.

One of the most fascinating subjects for the seven- and eight-year-olds is still the human being, and many of them will be content to spend numerous lessons on variations of this; for example, in making families, in modelling tradesmen, the baker with tray of loaves, the ice-cream man with a barrow. We have to remember in choosing subjects that the attraction of colour is missing (though we may later paint the models), so we have to look for subjects with interesting *shapes*.

Animals, real and fantastic, provide a wide field for choice and, of course, both animals and figures may be inspired by stories told or read. Where a child wants some toy object to be used in his own games or daydreams, he may be encouraged to make it, but there is no point in suggesting this as a class subject. Young children will tackle subjects we would consider very difficult, and need not be discouraged. Their interests will also lead

them towards modelling things which are perhaps less suitable for clay, such as engines, motor-cars; and when they themselves begin to be dissatisfied because they cannot adequately represent wheels and axles, then we can suggest that these might more appropriately be made out of card or metal.

The same range of subjects can be carried on with the eights or nines and extended to subjects like the market or the fairground. At this age they enjoy making a series, such as modelling mother working on the different days of the week—washing on Monday, ironing, baking, shopping, visiting on other days. The complex piece built up of separate parts fashioned with patient care can also be expected by nine or ten—the farm with buildings and animals, the barrow piled with vegetables of different varieties, the figure dressed by making garments of flat pieces and wrapping them round.

All these types of subjects can be carried on with the tens to elevens, along with pottery and tile-making if we choose to begin it then. If there are no facilities for firing, the bigger jobs such as the farm and the fairground may be undertaken by a group of friends so that they can be completed in one period.

On almost all occasions I would suggest more than one subject, giving the children a choice, and, when a child has something he very much wants to model, let him do that instead of the suggested class subjects. The essential thing is to find for every child in the room something he *wants* to do. Without that spark of enthusiasm he will not make anything satisfactory to himself or you. By asking for suggestions from the children you discover their interests, and if the suggestions are stereotyped or have been used recently, you can give them a new slant. If the same boy always wants to model a boat, you may suggest that he makes a canal with a boat in a lock one week and a harbour with many boats the next.

These suggestions for subjects are to be taken in only the most general way. Children of five, ten, and fifteen will all tackle the same subject, but they will treat it in very different ways. The essential thing is to make use of the spring of interest in the children.

In suggesting to any group of children a subject, there are two things to consider, the natural interests of this age group and the material. We must beware of accepting too arbitrary age divisions. Of course, there is a great deal of overlapping, and many children have a pet subject such as houses or boats round which they work for a long period. There is, then, a great need for freedom of choice. But by freedom I do not mean saying to the child, "Now, model anything you like." This leads to apathy and dull repetition. The child who has a problem to work off his mind will find an outlet for it if you give him a wide choice of subjects. It is not enough to say just, "You may model a man working, or child playing, or an animal." This is distracting, and not one subject in the list is lit up by that spark which is usually needed to pull up the emotion involved in creating. The telling of a story involving several characters, perhaps both animal and human, for example, "Goldilocks and the Three Bears," The Scene Behind a Circus Tent, The Toy-shop, A Picnic, will evoke several images from which the one which most appeals to the child

will resolve itself more strongly and firmly than the rest, crying for expression in concrete form. This provides variety without distraction. And, if one model is soon finished, another from the scene is waiting to be pondered on, to serve in its turn as inspiration. This avoids those gaps in which one thing is finished and the teacher has yet no time to come and suggest individually a new idea. Then if three or four figures are modelled, the group will form a whole and not a disconnected collection of objects.

The Material modifies the Subject

But this starting from the child's interest must be related to the material. Clay is very suitable for representing men and animals, but wood, boxes, scrap metal are not. These suggest, rather, houses, trucks, toy furniture. Not that one cannot make a satisfactory animal out of a box, some sticks and corks, but, to insist on it is to deny the material the right to suggest its own forms, and this is a very dangerous habit. To let the beginner handle several materials and to let each material out of its own character—hard and grainy like wood, hard but chippable and porous like brick, soft and pliable like wool—speak and suggest its own forms, that is the beginning of all true craftsmanship, and without that there is no beginning.

The material in this case imposes its own modifications of shape. The horse, for instance, cannot stand up on four thin legs in soft clay. Therefore, it must either stand on four thick legs and be a cart-horse, or else it must lie down. Next time, the child will know that he cannot attempt a deer in this material, but a pig is likely to be successful.

The shape of the horse is modified because it is being made in clay. I believe this is something most children grasp instinctively, but we adults have got to make the effort to grasp it consciously. If we are going to make any comment on the children's work at all, we must be vividly aware not just of what clay will do and not do, but of what the particular batch of clay we have given out that morning may be expected to do. If the clay is fairly soft, the forms which emerge will be different from the forms of the same subject when the clay is rather hard. So I do most strongly advise every teacher to have her own piece of clay either on her desk to handle or model with first, or unobtrusively in her hand as she walks round. Then she will appreciate the shapes which are being made and see why on one particular day all the animals and people have to sit down, and why on another day their arms and legs tend to break off.

In the same way, the variety of clay itself tends to different forms. If a tile or a model of any considerable thickness is to be fired, then it is better to mix sand or grog with the clay to open the pores. This makes the clay more "short," and fine detail cannot be obtained. But the rather solid, stumpy forms which come naturally to this short clay are pleasant in their way. The most important thing always is not to expect or *ask for* naturalistic representation, that is, the mere copying of a shape existing in the world.

Naturalism and Symbolism in Modelling

Even the most naturalistic painter must necessarily achieve some degree of

abstraction because he represents a three-dimensional world on a flat canvas or board, that is, in two dimensions. The sculptor is curbed in any tendency towards naturalism by the very hardness of his stone and the necessity for compact form. But the modeller is laid open to all the temptations of representation in its worst forms. To represent one form as exactly as possible in another material and on another scale is the work of a scientific mechanic, not an artist. But the children are daily surrounded by pressure towards this kind of "art." Young children work naturally in symbols, as does the artist. Just as the young child painting indicates the eyes by two dots, so does the child modelling push in two hollows with a pencil-point (disregarding the fact that the eyes protrude) or fix on two balls of clay (disregarding the fact that the eyes are almond-shaped). These two symbols for eyes indicate two different psychological types of child. Development must come as a clearer conception of what is to be portrayed, and secondly, a more clearly differentiated solid form to convey that conception, not necessarily as a more exact physical likeness to the "subject" at all. As I said, the environment is all against this, so we must take pains to encourage it. It has been a revelation to me how much more the quite young child has to express than a mere "model" of something. Who will deny that in Plate I what is being felt, what is being portrayed, is not a cat and kittens, but the tenderness of a cat to her kittens. The personality of the individual child, the stage he has reached in his development, and the mood evoked by the teacher all play their part in determining the angle from which any subject will be treated.

Encouragement and Criticism

In all the arts subjects of the curriculum, we have to bear in mind that we are asking for something which springs spontaneously from within the child, how he sees something or how he feels about it, so we have *no right* to criticize his conception. We have the right of any other human being to say, "I like that" or "I don't like this," but even that should be used sparingly, just because the prestige and power a teacher has make her words weigh heavily. We need not be niggardly of praise. But, while every child is to be encouraged privately, I would be cautious about displaying the work of one or two children too ostentatiously. Some teachers would go farther and say never praise a child's work until a considerable time afterwards, when the temptation to imitate it in order to be praised cannot operate. The shy or backward child can be publicly praised when all the models have gone back into the bin, or when those which are to be kept have been unobtrusively put away out of sight. Otherwise our mission of helping each child towards his *own* form of expression, his own language, will be frustrated by his desire to do what teacher, with all the prestige of authority and the added claims of affectionate regard, says is good.

Practical Help

On the other hand, we have the right and the obligation to give practical help. We may not know more than he does himself about what the child is trying to say, but we have had more

experience, so we do know more about clay. When we see a little model cracking and falling apart, we can say, "You have been working that piece long enough, and it has got dry. Roll it in your damp rag and get yourself another piece. In half an hour it may be ready to use again." We can suggest that big, heavy feet will help an unsteady man to stand upright, and that a dab of slip on a finger will help to cement two parts together. The wise teacher will be able to distinguish between this occasional *practical* help and *interference.*

The Changing Vision

When the children reach 11 or 12—or earlier in some cases—their way of looking at things usually changes. They may want to model a coalman seen in the street, or the puppy at home, and be distressed and dissatisfied because they cannot get it "right" or like enough to the original. The symbol no longer satisfies, and the pressure of naturalistic standards at home and in advertisements and illustrations and public monuments sets a standard of naturalism which the child cannot achieve. This stage is not necessarily a more advanced one, and certainly is not if it results in mere naturalism. It must not be hurried on by us by criticisms of the younger child's work which would only be applicable if he were aiming at making an exact copy—which the younger child is *not.* So we must wait for definite evidence that the child himself—each individual child—has turned over from the confident portrayal of his inner conception to real observation before we criticize from our viewpoint of observation. If the child says, "I was looking at the cat, and his back legs join in here somehow," then, and then only, can we say, "Well, let us look at the cat and really see how they do." Such a suggestion would be an interference with the child who is modelling not *the* cat but his inner picture of a cat. Whereas to the child who has come to observe, and who wants to portray what he sees, it is necessary. But there are dangers at this stage against which we must guard. Through the outside pressure of which I spoke, his attention may easily be concentrated too much on faithful copying, and he may miss two other and much more important components of any work of art—for the child's work can be, in some degree, a work of art. These are design, an arrangement of forms which is satisfying, and what I would like to call the informing spirit of the whole. This is the catlike quality in the "Cat and the Kittens" and the tired, bent feeling in "The Old Men." In essence one can hardly separate these, but at one moment one may be uppermost in the worker's mind, at some other moment, another. When the child appears to be worried by his lack of technical efficiency, when he wails he cannot get it "like," we can draw his attention to these qualities and praise them in whatever degree he has achieved them. Where we put the emphasis will help to balance a little the craving of the rest of his world for "a likeness."

To have children not only of several different types but of many different stages of development is our lot, and our only hope is to adopt that attitude of expectant awareness which will sense and meet the needs of each individual child.

We can also help by showing how this material, clay, not only limits the

form to some extent, as in the horse, but does itself suggest forms to represent—not imitate—natural forms; how scratched lines will represent hair, dots or coils of clay pressed on represent fur, and so on.

Methods of Modelling

We have talked about subjects for modelling, of the necessity for choice and variety, but what of methods of actually putting the clay together? And what of the different ways in which the child may interpret a subject? Is there one correct way of modelling?

Certainly not, there can be as many ways of modelling as there are children. Another advantage of clay is that the technique is so simple that it does not need to be taught. If you give a group of children lumps of clay, they will not say, "What do we do with it?" or "How do we do it?" as they might with embroidery or spinning materials. They plunge in and begin to model as though it were the most natural thing in the world, as indeed it is. No tools are needed, so that nothing, neither learning to use a tool nor learning a technique, stands between them and the thing they want to make. This makes it a specially suitable material for the youngest children, and for those of an older age who are clumsy, nervous, or uncertain of their ability to cope with tools.

The great artists who used terracotta (which is just baked clay) as their material used many different styles of modelling, and so will the children.

Some will continue to press their little models out of one solid piece. Some will early begin to make separate pieces for limbs, and so on, and join them up into a whole. These last may be shown how to scratch the surfaces to be joined and cement the two pieces with a touch of slip, as with glue. But one method of work should not be forced on all children. These differences belong to differing types of personality, and each can best be helped within its own way of working. At some later age, when the confident attack of the young child is lost, and inspiration fails, the lagging children can be gathered in a little group and taught as a game "from the other way round." For this, one suggests that each child makes and lays in front of himself a series of balls, sausages, and strips of clay, and that these units be combined in different ways until they suggest a form which can be developed and elaborated.

Fantastic little animals can be made in this way. One can pick up one of the sausages of clay and bend it in various ways and say, "This is like the back of a cat when it arches it, while this is long and lank like a greyhound. Now see what *your* sausage will make." Then head, tail, ears can be added. In the same way, a fat sausage will suggest the shape of a pig, and a thin sausage will be more suitable for a running hare. But it must be emphasized that this is "the other way round," a piece of fun to stimulate ideas and encourage experiment. It can be usefully used, too, when the children have been using some other material a good deal and continue to think in terms of it, as when they have been carving wood with penknives and want to carve clay. But the normal way of approaching a subject for children who have had that preliminary time to "play" with

the clay, handling and squeezing without necessarily being urged to make, is to choose a subject and let them try to represent that, adapting their conception as they go.

There are many subjects for which clay is hardly a suitable medium at all. One should never ask children to reproduce a daffodil or a fern in clay. The nature of clay is not suited to the delicacy or the springing line of growth of most plants. It is too difficult a problem for them. Clay is a wonderful material for representing three-dimensional objects, built up and seen from all sides. So it is wise not to choose a subject which cannot in fact be built up, such as a daffodil, but which must be laid down on a board and treated like a bas-relief.

Some children, however, may not fully realize the possibilities of building up, and may, in fact, choose to do a subject which has to be laid "flat." Then it should be pointed out to them that here is their opportunity to model truly in the round. In fact, it is a good plan to introduce early the concept of "round." Let the children talk about the word and name things that are round. Point out that we speak of "Round as a penny," and also "Round as a ball"—the older ones can be introduced to the more correct words "sphere, spherical." Show them a ball of clay and contrast it with a flat circular piece of clay. Point out what exciting new possibilities this opens for them. These children have probably been used to drawing or painting a head as a circle or oval. Some of them may tend to press a circle or oval out of the clay, lay it flat, and draw the features in with a pencil or with strips of clay. But this is to miss all the possibilities of the new medium. A head can be formed of a lump as big as they can comfortably hold in one hand, and with the other hand the features can be pinched out, or added with strips or balls of clay. The children should be discouraged from simply drawing on the surface of the face or the figure with a pencil or other tool, and shown how details can be *shaped*, as opposed to *drawn*, by moulding the clay. When this has been explained and practised, and we are quite sure that the children have understood, there may still be some who revert to drawing on the surface of the clay. Those may be left to go their own way, as they are probably more naturally draughtsmen than modellers and will express themselves better in paint and paper.

Group Work

Because of their growing individuality and the need to assert themselves as persons, the younger children often find it difficult to sustain interest in a group model. So, though group work is to be encouraged where it arises spontaneously, it should not be forced. If the room has tables round which the children can group themselves, freedom is possible, and the individuals join in the project of the table, or work on their own as they feel inclined. It is harmful to insist on any arbitrary grouping or on any child always joining a group. In a great many activities in the Junior School he will be treated as one of a group; here, in claywork, is the opportunity to let him feel an individual, to let him make something that is his alone. In nearly all class lessons some sort of pace must be kept up. Because of the size of classes, each child cannot proceed at his own pace. But in

clay modelling here is the opportunity. It is often during these years that the habit of following a leader begins to grow; the sense of comradeship is valuable, but the dominance of the leader is too apt to produce sheep-like followers unless these followers are at the same time given a sense of their personal worth as individuals. Probably the art and craft lessons are more valuable as providing this counterbalance than as a field for the activities of a gang or group. Children who group themselves out of doors under a leader often choose quite a different leader in lessons. Out of doors they often choose a daring spirit, indoors someone who has more knowledge or ability than they have. This is a healthy balance. So when children do group themselves to undertake a larger amount of work than any of them could accomplish alone, the corresponding satisfaction may be greater for them all, but the leader and the form of the group must be of their own choosing. Some of the suggestions already given lend themselves to group work—the farm, the street market, shops, house-building; a seaside scene with rocks, lighthouse, boats, etc.; a railway line with tunnel, bridges, stations, etc.

The nativity (Plate I, lower picture) is a co-operative piece of work undertaken by a small group.

Layouts in the Garden or Playground

A larger project by a group or an individual can be worked out in the garden or in a protected part of the playground. This gives more scope for building up on different levels, too, and getting the feeling of three-dimensional space *enclosed* as well as three-dimensional space *occupied* as it is in a solid model. This can be related to many other lessons, e.g. to geography, where such a layout might be made first of the locality within sight, the school playground, surrounding houses, and so on, then widened to the locality known within a certain walking distance, and so on, till the concept of mapped space is a familiar one. But it is an excellent idea to have a piece of imaginative work on a large scale going on. The school which produced the "cat and kittens" was embarking on a farm laid out on the ground. The sods had been taken up over about three square yards, and those were being used for banks. The lay-out had been done by general agreement, and each child, or sometimes groups of two or three, was starting the buildings and animals which could be done indoors or out according to the weather. When fired, they were to be all assembled on the site and could be moved about and rearranged at will. There seems great scope for experiment here,

CHAPTER FOUR

HAND-BUILT POTTERY

The Approach to Pottery

ALL potters agree that you cannot learn to make pottery from a book; therefore, if you—the teacher—really hope to be a potter, there is no alternative to finding yourself a master and tackling the thing thoroughly from the craftsman's angle. Then you will, of course, be a much better teacher and have a wider outlook on life. But if you are teaching only Primary School children and do not want to tackle wheel pottery, there is no reason, I see, why you and the children should not explore together the simpler technique of claywork.

It could appropriately be approached as an environmental study if the district lends itself to that. It will be interesting to press clay inside baskets and find the impressed pattern, as was done in primitive settlements, and to build a wattle-and-daub hut in the garden. Districts with Roman remains will arouse interest in tiles and mosaic work. But if it is to contribute anything to the art side of the curriculum, it must not stop at imitating the past. It must be used as a material for free creation in the present.

Uses of Clay at Various Stages

Since, as we said, clay is primarily a material for imaginative work in the early years, then claywork in the Primary School will be mostly in the form of modelling. This can be either simply one of the materials available in the free activity period or it can be a class lesson as I described.

Probably some of the children will have been trying their hands at making pots or cups from time to time, especially for their games, but it is modelling which will be found most rewarding and absorbing. When children are about ten years of age, I would introduce hand-built pottery as a class subject, giving an occasional lesson to it among the modelling lessons. In the case of thumb-pots, each child can make one at the beginning of the lesson (this only takes about ten minutes, then the lump of clay is beginning to get too much handled) and go on to modelling for the rest of the lesson. When the children have had some practice in this way, a whole lesson can be given to thumb-pots, each child making several and decorating them. In this way the elementary techniques of hand-built pottery can be given to all the children, and those who wish to make pottery and tiles can go on experimenting and practising, while those who prefer modelling can carry on with that. For pottery a little more equipment is needed, and it is essential that every child should know what each item is and where it is kept (preferably on a hook or shelf space appropriately labelled), whether he needs them all or not.

Which Types of Pottery are Educationally Valuable?

The processes of pottery have developed technically so far in this country that they now bear little relationship to the elementary and basic processes. Practically no hand-throwing is done in the majority of large-scale potteries. The processes are very complex, and designed to carry out a standardized job with large quantities of material and large numbers of highly finished identical products. Out of the very many ways of dealing with the material we have to select not only those which are possible in the very different conditions of a school, but those which have the highest educational value. In order to do that, we shall have to be quite sure what we mean by education and what we do in fact value.

I suggest thumb- and coiled-pots because these both develop a sense of form while directly handling the material all the time, and requiring almost no equipment. And I suggest tiles because, while thumb- and coiled-pots need some practice, a tile which can be fired and used at home can probably be made at the first attempt. Several tiles can be quickly made and serve for practising those types of decoration natural to clay.

Equipment for Hand-built Pottery

Coiled- and thumb-pots can be made with no special equipment at all, but the boards of which we spoke are useful, espcecially in building coiled-pots, because the pot can then be lifted and turned continually in the process of building. If these boards are not available, an old plate makes a suitable base, since it swivels easily.

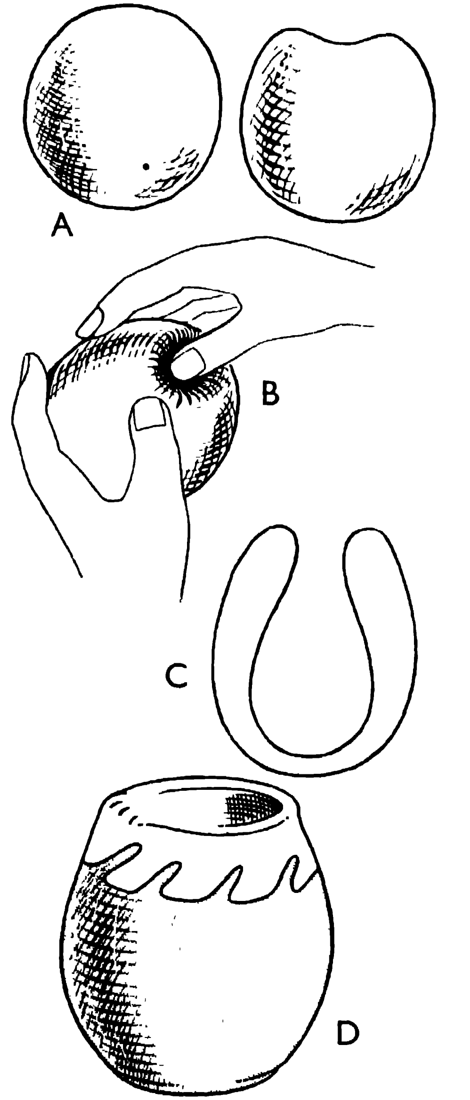


Fig. 6.—Making a Thumb pot. (A) A Ball of Clay is flattened a little at the top. (B) Position of Hands for Hollowing. (C) Section before the Walls are finally thinned, and (D) Finished Pot dipped in white Slip incised with stub end of Pencil.

Hand-built pottery and tiles are made much more interesting by the use of coloured slips, which will be described in the chapter on Decoration. To mix these slips, you need stiff

brushes and a sieve and several utensils to hold the slip, such as basins and jars. The preparation of slip is described in Chapter VI.

Thumb- or Pinched-pots

This type of pot was made by early man and brought to a very high standard by some of the African peoples. It is still used to produce the beautiful Raku tea-bowls of Japan. One begins with a ball of clay, held probably in the left hand, and by kneading it round and round with the right arrives at a sphere. Then the top is gradually dented with the right thumb whilst the right-hand fingers continue to move the ball round rhythmically. Gradually, a hole is worked down to near the base, keeping the sides of even thickness all round (Fig. 6).

Then the movement is changed slightly and the base and walls are gradually pressed thinner between thumb and fingers of the right hand whilst still turning it rhythmically in the hollow of the left. The shape is formed in this process, but a warning must be given against getting the top edge too thin, when it will crack. If it does tend to crack, it can be left, sitting

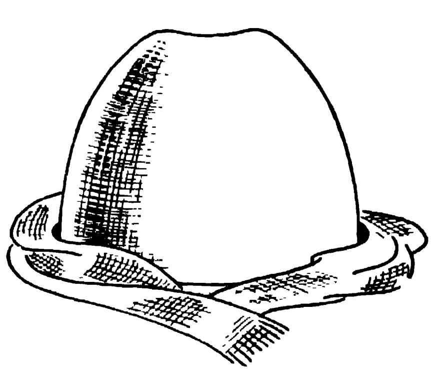


Fig. 7.—Prevent the edge drying too much while handling by inverting Pot on nest of damp Rag.

upside down to take the weight off the base, on a nest of damp rag which will soften it again (Fig. 7).

All pots should always be put upside down to dry as soon as the upper rim is hard enough to take the weight. Otherwise, the rim with air all round will dry much quicker than the base, and the uneven contraction will result in cracks.

Although this, the simplest method of forming a pot, is included in the first section because it needs no equipment at all, it is not suggested that it should be done with the youngest children with hopes of achieving a firable pot. They have not the patience to work slowly enough to press the walls out to an equal thickness.

Coiled Pottery

In the arts of primitive peoples, and indeed in highly developed arts too, we often see how the methods of one art are carried over to another. Sometimes, what was a constructive necessity in one becomes merely a form of decoration in the other, and sometimes the form of construction is carried over. So it may be with coiled pottery. We know that in order to hold the soft clay in shape, early potters sometimes formed a pot by pressing clay inside a basket, and as the pot was fired the basket burnt off, leaving the plaiting of the osiers as a surface pattern. The plaited effect was sometimes imitated in the decoration, even when the pot was made by other methods. Coiling itself may well have been suggested by the method of *coiling* baskets. Such coiled vessels are found in great variety among the dwellings of the New Stone Age people in many parts of Europe. They are frequently decorated with plaited

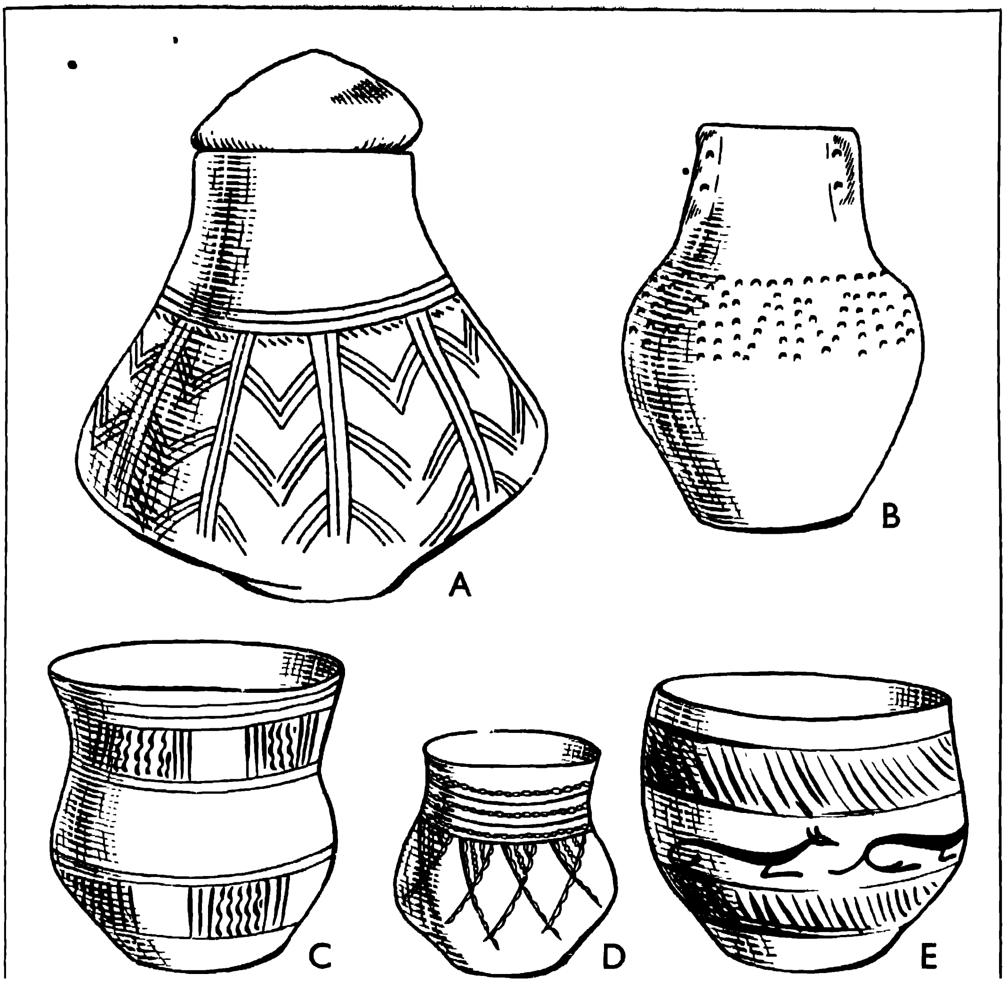
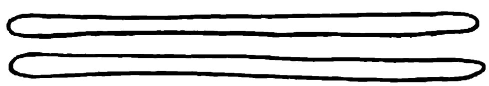
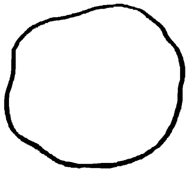


Fig. 8—Early Iron Age Pottery decorated with Incised Strokes, (A) with the impress from a small round Tool (B). New Stone Age Pots, showing Decoration derived from Basket-work (C), and from the String Net used to carry the Vessels (D). (E) shows a combination of Scratching and the earliest Painting.

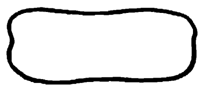
and notched patterns which are derived from basket-work (Fig. 8).

The coiled method is used to make many types of pottery, including large indigo vats by modern Nigerians. So here is another method of building without a wheel. To be practical and act as a vessel for holding, the coils must be joined. This can be done either on the outside or the inside, or both, and a thick slip can be used to fill the cracks. There are two methods of making the base. A long sausage of clay can be coiled round itself to make a circle, or a ball of clay can be flattened with the closed fist and, if necessary, rolled with a rolling-pin till it forms a flat circle about three-eighths of an inch thick.





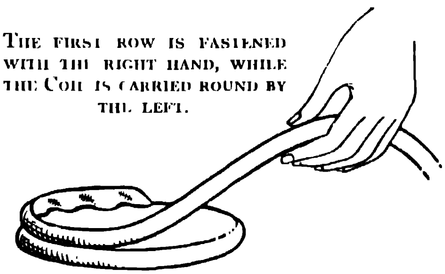
A Ball

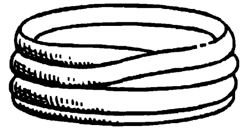


is flattened

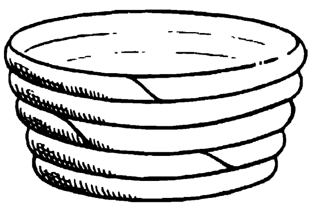
to a Pancake.

The first row is fastened with the right hand, while the Coil is carried round by the left.

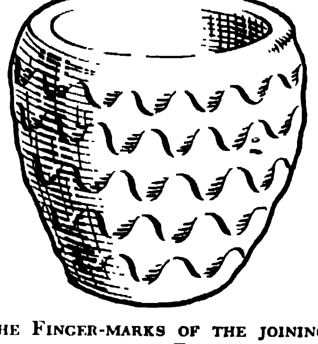




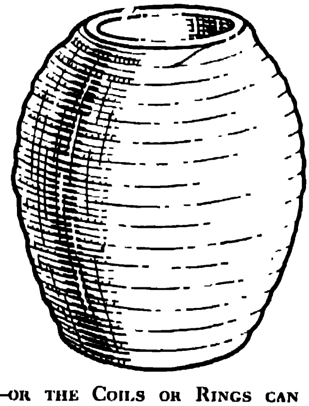
In Oblique Coiling, each Roll is carried round to the row above, and the new one joined wherever the end happens to fall.



In Ringing, the end of each Roll is joined to its own beginning.



The Finger-marks of the joining can be left as a Decoration—



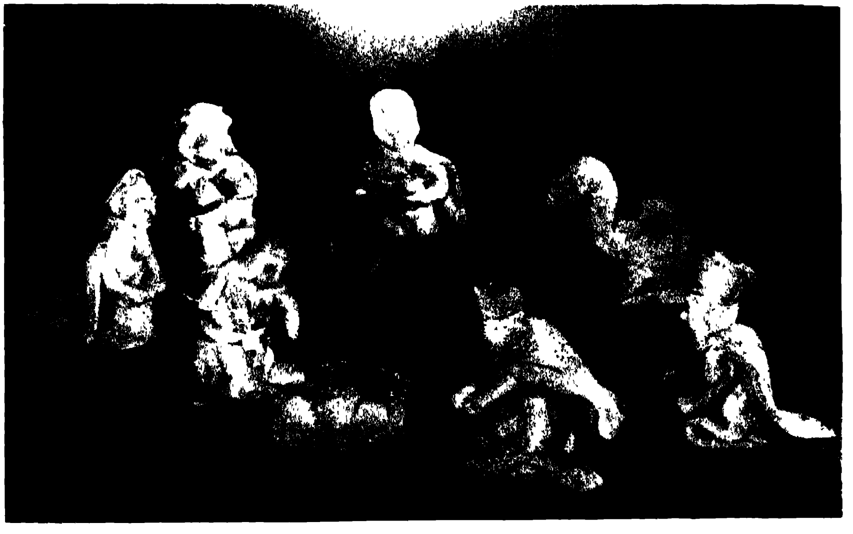
—or the Coils or Rings can be partly or entirely smoothed out.

Fig. 9.

CAT AND KITTENS

In spite of difficult conditions, large classes and the lack of space to keep equipment indoors, interesting and varied work in clay is produced in this school. This group by a child of 9 shows a thoughtful and sensitive appreciation of the subject.

Cort Crescent Junior School, Leicester. *Headmaster* . A. E. Goddard



THE NATIVITY

For this simple Nativity group, each child chose one figure and then all were combined in this little scene. It is interesting to see how the heads have been conceived in much more detail than the legs and feet, and how in this case the figures have obviously been modelled first and the cloaks and crowns added afterwards

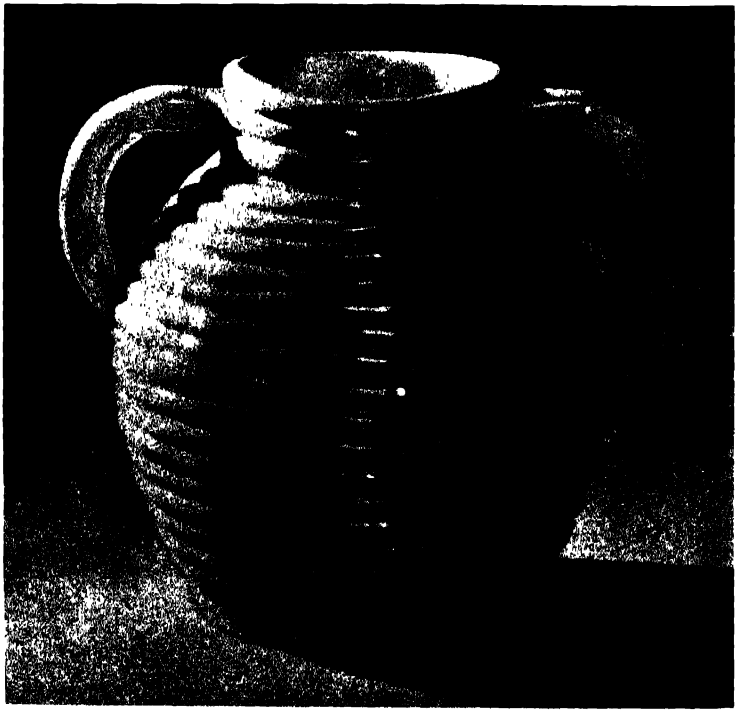
County School, Brighton *Teacher* Monica Caldin.

PLATE II

CLOWN AND TWO OLD MEN

The aim of this teacher was spontaneity, so subjects to be executed in ten minutes were given. These three little models have just this quality of spontaneity and they have in addition a definite feeling for the character portrayed. They were done in a class of twenty working for one hour a week.

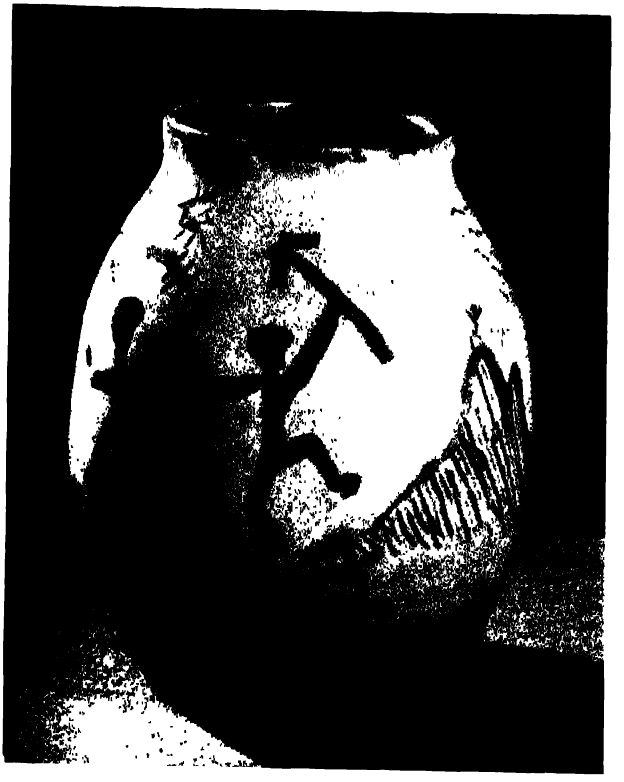
Hugh Bell School, Middlesbrough. *Teacher* : Mary Watson.



COILED POT

A coiled pot built up in rings which are well smoothed off on the inside. The simple shape is finished at the neck by two or three rings built upright and is relieved by the interest of the rings left showing outside. There is, for a child's work, a good relationship between the neck and the base. The fairly large shapes natural to the fingers are kept throughout. There is nothing finicky. The handles are obviously important to the child and so are rather large and thick, but they fit in well with the coils and are joined thoroughly. The finished pot is glazed with a clear yellow glaze.

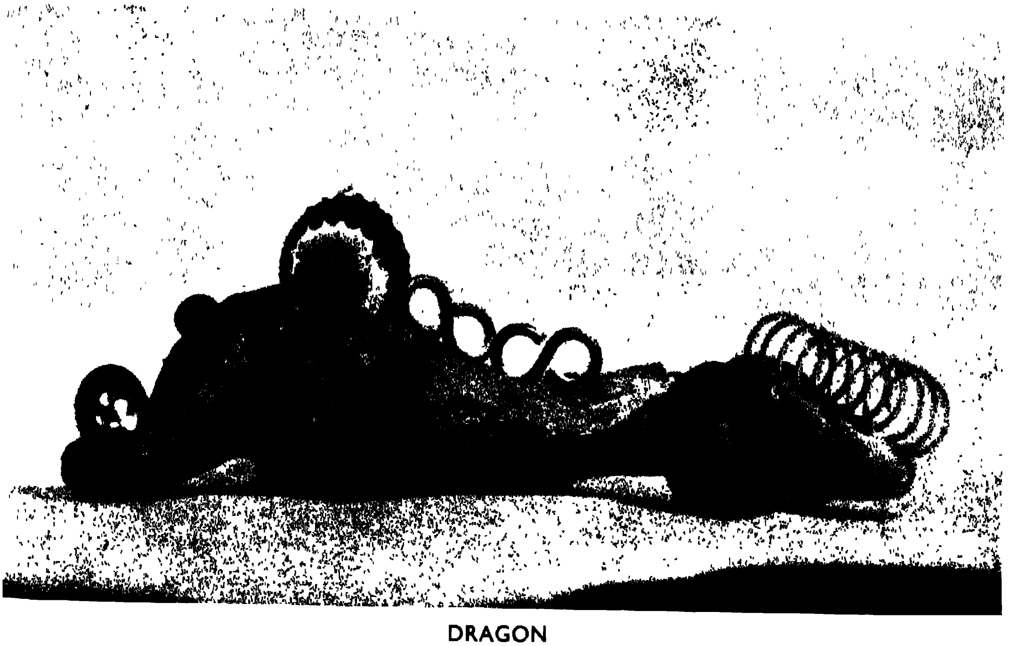
Hugh Bell School,
Middlesbrough.
Teacher : Mary Watson.



COILED POT SLIPPED IN WHITE WITH DECORATION SCRATCHED OUT

This pot in brown clay of a simple hand-built shape is made interesting by the very free and direct sgraffito, or scratching of the white slip in which it has been dipped, in order to show through the brown clay underneath. The decoration is completely childlike and appropriate. The workshop in this school is a converted stable. The teacher had no training in pottery but learned in a local pottery and experimented along with the children.

Wennington School,
Wetherby, Yorks.
Teacher : Louis Jones.



DRAGON

This fantastic animal was executed very quickly and roughly in clay, metal pieces, buttons and bottle tops. It serves for the expression of the moment and is not intended for a permanent piece of work. It is rather in the nature of fun.

Mixed out-of-school group.

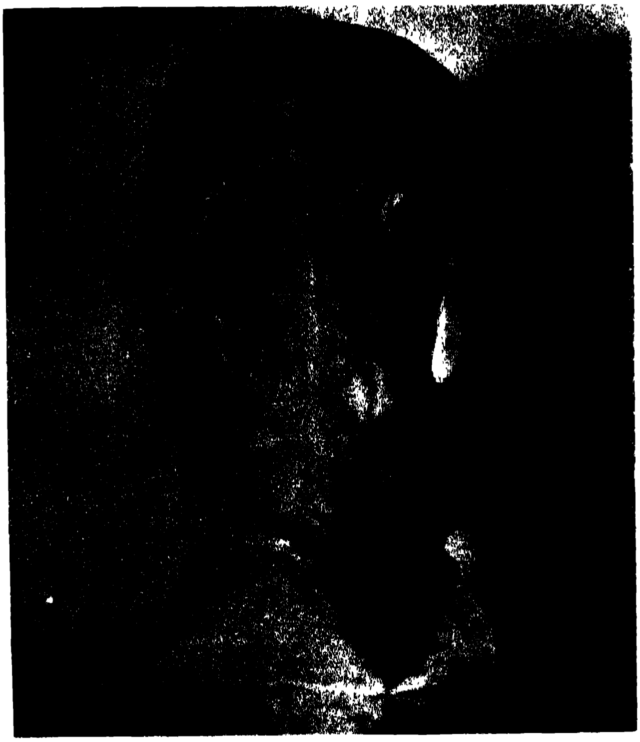
Teacher : Seonaid Robertson.

PLATE IV

PLASTER PIG

In this instance the boy said he wanted to make a pig and a block of suitable shape was chosen. It was worked with an old chisel and finally painted. Within the limits of the original box shape of the block, the solid, heavy form of the pig is well conveyed. So are the characteristics of a pig, the stocky, imperturbable stance and small inscrutable eyes.

Colet Court School, London. *Teacher* : B. Lasenby.



HEAD

A carving from a natural lump of chalk turned up in the playground when air-raid shelters were built. Obviously great pleasure has been obtained from smoothing the dome of the head, and the static features are reminiscent of primitive carvings.

Hitchin Road Junior School, Luton.
Headmaster : Mr. Swallow.

On this base the walls are built up of sausage coils. It is often easier to prepare a number of those and then build up without a break for preparing more. Either the coils are carried up continuously, which gives an oblique angle over the join, or one coil is joined to itself in a circle and a fresh one is begun above that and joined to itself, in which case they are called rings. In both cases the joins are spaced round for strength instead of being put one above the other (Fig. 9). The first coil or ring must be thumbed securely down on to the base and the next coil joined firmly to that one. These methods can be learned more quickly by practising for an hour or two under a master than by any amount of description. As the tendency is always for the pot to fall outwards, it is best to begin by building one coil straight above the other as for a jam pot. This will in fact come to slope slightly outwards, and the builder will learn the strength of this tendency and come to allow for it. When the method of the continuous coil is used, it is better to level off the coils at the row before the final one. Then the final row is added and joined to itself as a ring, which gives a better finish and keeps the top more even.

By this method pots can be made larger than by the thumb or pinched method, and this is more satisfying to some children.

For coiling, the clay must be in really good plastic condition and have more grip than it needs for modelling or tiles. If one clay serves for different kinds of work, it is best to order the most plastic clay available and mix grog with part of it in a pail. This mixture can be kept for tiles and larger modelling. The larger the pieces of solid clay to be fired, the more the clay will need "opening" with grog to fire successfully.

In any job where a number of coils or pieces are required, they can be kept wrapped in a damp rag beside the board until each is needed. Otherwise they will dry off too much in a warm atmosphere.

This method is enjoyable in the doing (as apart from the satisfying result) only if it is built with a rhythmical movement, laying on the coil with one hand and pressing it down regularly with the other. If there is room, this can be done most easily by walking round the pot. If not, the base may be laid on an old saucer or plate to rotate easily, or, failing that, on a piece of wood which is turned round by one hand whilst the coil is laid on by the other. The older boys may like to make a primitive turntable for coiling and modelling by fixing a bolt through the centre of a circular or six-sided piece of wood and down through a bench or block of firewood so that the top circle rotates when turned by hand. This is another direction in which your simple equipment can be extended (Fig. 10).

The finger-marks left in pressing down the coils leave a pleasant texture if they are regular, but one does not want to make the surface fussy by too much prodding or thumbing. A coiled-pot often looks more finished with a thicker coil round the neck and perhaps the base. A great variety can be achieved by the different thickness of coil and the different methods of fastening down. These range from leaving the coils untouched outside (all the fastening together being done inside), as in Plate II, lower picture, to smoothing the outside completely and even brush-

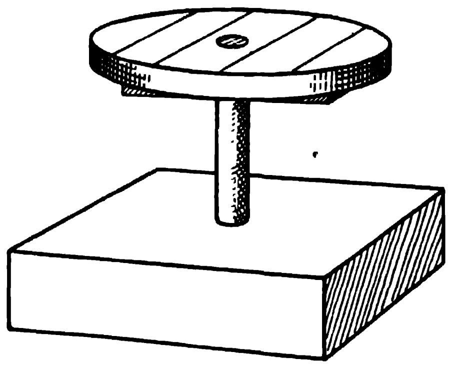


Fig. 10.—Home-made Turntable, with round Top on revolving Pin sunk in Block of Wood.

ing on slip or dipping in slip to give a smooth surface. If they are smoothed off, the pots can be decorated in one of the ways suggested. Plate III shows such a pot dipped in white slip and with a lively, exuberant design scratched by the child with no preliminary drawing.

The Best Clay for Tiles

Now we can consider tiles which children can learn to make without much practice.

Whereas for pottery made in the hand the clay must be in the most plastic condition possible, this is not necessary for tiles. This means that before you have learned to regulate the condition of your clay completely, you will be able to adapt your work to the condition of the clay that day. Later on you will know by experience how much damping it needs and be able to have it in good condition for whatever work you propose to do. Although a few of the children should be detailed off to look after the clay, it is necessary to inspect it on the afternoon before any special work is to be undertaken, and redamp it, or let more air get to it if needed. Otherwise the whole class will be held up next day.

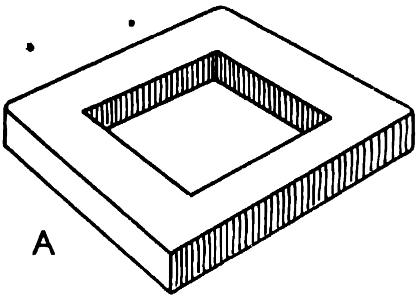
Since a tile is not of a shape and thickness which makes it amenable to firing in a home-made kiln, it is, as with most clays, helpful to open the pores with the addition of sand or grog. If a quantity of this sandy clay is mixed ready, it should be kept separate from the plastic clay. But it is quite feasible to keep the main supply of clay always the same, and let each child mix a little sand or grog into his handful for his own tile. Any proportion up to 50/50 will do, but many clays will not stand more than 20 per cent. without becoming too short to work.

Tiles and Pancake Pottery

Tiles can be made by rolling out flat slabs of clay on a board or flat desk or table, so that rolling-pins of some sort are required. For these, empty bottles will serve. This equipment serves, too, for pancake pottery, which will be described. But the more professional and satisfactory way of making tiles is in moulds or boxes.

Rolled Tiles

The simplest sort of tile can be made by rolling out to even thickness a slab of clay and cutting it to the shape desired straight downwards with a knife. A tile for a teapot stand can be round, or square, or six-sided, or what you will. There is room for variety in its shape and decoration. Types of decoration are suggested in the chapter on that subject. One needs only to emphasize here that the decoration must be appropriate to the outside shape as well as to the method of decorating itself. During drying, the tile must be turned upside-down several times, to prevent the corners turning up as the top and drier surface shrinks. Tiles to hang on the



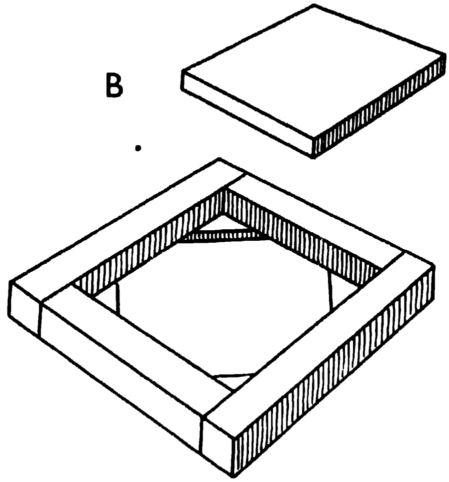


Fig. 11.—(A) Sunk Tile box of Plaster (B) Tile box of Wood with detachable Base.

wall can be decorated in bas-relief, but the more practical tile for use will need to be flat, and can be decorated by incising or with slip.

These tiles can serve as stands for plants in the classroom, or a row of them can be made of a size to cover a window ledge.

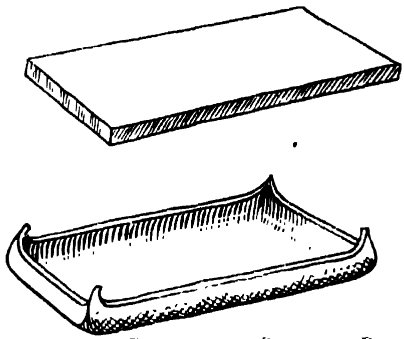
Making Tiles in Moulds and Boxes

Tiles can be made by rolling out clay as already described. But a more economical way is in tile moulds. These can be made of plaster of Paris or of wood. The plaster-of-Paris type is made by placing a tile of the desired shape cut in clay at the bottom of a box. The box must be larger than the tile. Pour in plaster of Paris (for plaster of Paris see the Chapter on Carving) to a depth of one inch. When the plaster is dry, and that is very soon, scrape out the soft clay. The mould is then dried off thoroughly. The best way to fill the mould with clay to make a tile is to lay in small sausages pressed against the bottom and sides, to obviate air bubbles, build up to the top and level off with a wet ruler. The plaster will dry the clay, which shrinks a little, and the tile can be shaken out gently in a few hours. It should be turned upside-down once or twice during the next few days to dry both sides equally.

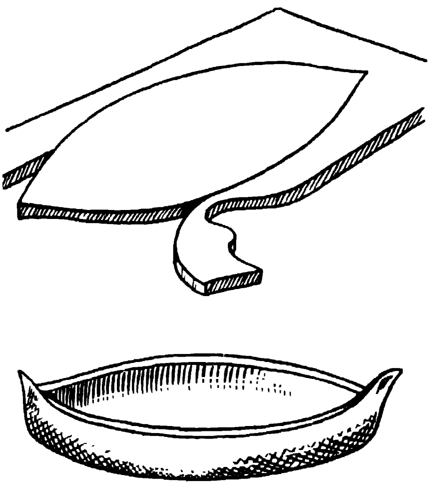
Remember, that if your clay has not already a good mixture of sand in it—"short" clay—mix in grog to open up the pores. The best sort of tile-box, which can be used over and over again without this pause for shrinkage, is made of wood. The part which takes the base of the tile lies loose on supports, so when the clay tile is pressed down firmly and is complete, it can be pushed up like a baking-tin with a detachable base; the tile is laid face downwards and the wooden base replaced. The clay will tend to stick unless a sheet of paper is put in first or the wood base is dusted with dry powdered clay (Fig. 11).

More Advanced Methods of Shaping

It is not suggested that wheel pottery should be tackled at the ages we are considering. Kick wheels are as yet too expensive and take up too much room to be provided in any number, but apart from that, few children under



A Rectangle of Clay makes a Sandwich Plate—



or a Leaf shape, a little Sweet-dish.
Fig. 12.

eleven have the strength and control of arm to centre and shape the clay. It is a technique which requires a good deal of practice, and one cannot expect the first efforts to be worth keeping. If a wheel is shared amongst the children, the turn of each child comes round so seldom that they cannot make progress. This is much better left to older ages; making hand-built pots develops a sense of form and of the possibilities of clay, which will prove a most valuable basis for later work.

There is little justification for attempting to cast ware with children. Obviously they cannot make the original mould themselves, and so the essential thing, the forming of the shape, is not within their hands at all. There would be no harm in showing them how a teacup is cast as part of their general education, but the casting of it fulfils none of the purposes for which we proposed to introduce claywork in schools. One is not forming a shape nor handling the material directly. Cast ware, while gaining fineness and delicacy, loses robustness and strength.

Slab pottery is made by rolling out flat pieces of clay which are then cut up according to a pattern and rolled or bent into shape like soft metal, and then jointed with slip. This is a method of forming a shape without a wheel, but it is open to two serious objections. The rolled clay is treated as wood or metal would be, and the result is nearly always hard and wood-like with beginners. The method contradicts the nature of clay. Then the knitting of the joints is very exacting if they are to survive firing. It comes much more naturally to young children to press firmly what they want to stick together, as they do instinctively with clay.

Pressed dishes are much more within the scope of these years, but one needs to make moulds to shape them of plaster of Paris. The children cannot shape these moulds themselves, and the whole thing becomes very complicated. But they can make little dishes by a process between slab-building and moulding, which avoids the hard edges of the one and the complications of the other. This is what I have come to call with children "pancake pottery."

PANCAKE POTTERY (Fig. 12)

From a good-sized ball of clay a "pancake" is rolled out evenly, about one-third of an inch thick, and the shape envisaged is drawn lightly on it. This shape is cut out, holding the knife pointed straight downwards as for a tile, and the outside waste pieces stripped away. For an exact shape, such as a square, a paper pattern can be made and used. If a piece of newspaper is used to roll the pancake on, it prevents its sticking, and the paper can be cut through, too. If a knife blade is slipped under a corner it can be tipped up slightly so that the corner can be pinched up. The first finger and thumb placed on each side of the corner are pulled up and inwards and the clay pressed together firmly. The secret of clean and regular work is to work fairly quickly and very directly. In the same way a leaf shape, moulded upwards at the ends, makes a sweet-dish, and an ash-tray can be made from a triangle or a square. The flat edge which was the edge of the tile can be decorated with notching or finger-pressing somewhat as shortbread is edged, or the centre can be decorated by one of the methods of clay decoration. These little dishes or tiles are useful for practising different methods of slip or scratched decoration, so that when children do make a usable pot they will better be able to recognize whether it needs decoration, and to visualize which would be a suitable type.

This pancake pottery opens up considerable possibilities, but one does need to be on guard against encouraging frilly or tortuous shapes; the simple and natural must be encouraged. A shape which is considerably raised up from the horizontal may need little buttresses of clay to support the raised parts till they dry.

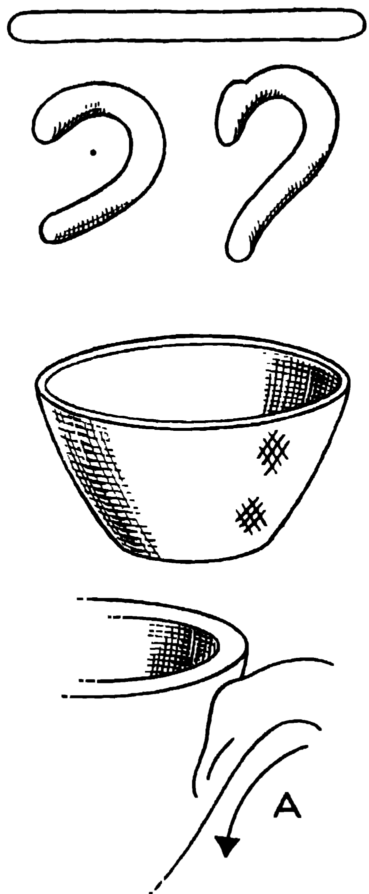


Fig. 13.—PUTTING A HANDLE ON A CUP. (A) DIRECTION OF THUMB-STROKE.

HANDLES

Putting on a handle in the right place of the right section and the right shape, allowing for the right amount of shrinkage, is a very skilled business. The craftsman's way of stroking and wire-pulling handles can wait until the children have had much more experience, but they will undoubtedly want to attach handles to their beakers or cups. They can be helped to choose a piece of clay

in good plastic condition, to roll the clay to an even thickness, to flatten it perhaps into an oval rather than round section. This is bent into shape (Fig. 13), allowed to dry a little, and the ends flattened. The surface of the pot where the handle will meet it is scratched to grip better, a dab of slip is pressed in to cement it, and the handle is pressed on with a downward stroke of the thumb.

CHAPTER FIVE

FINDING AND PREPARING LOCAL CLAY

The Advantages and Disadvantages of Local Clay

THE educational advantage of finding and using local clay can hardly be overestimated. When children are early presented with so many intricate and highly mechanized devices whose construction they cannot understand, and whose source is so remote that they cannot envisage it, to work with something they have themselves found and prepared, which they have watched at every stage of its preparation, which they can link to the activities of their neighbourhood, is satisfying and revealing. And it encourages an awareness of the environment and its possibilities which helps to counteract the stress on imported and mechanized sources of entertainment.

While it is undoubtedly desirable that wherever possible the children should be taken to see clay in the ground and should dig some and take it back to school to work with, all teachers will not want to undertake the labour of preparing all the clay they will need to use. The final stage of this preparation, wedging or kneading, is difficult with small children, and without properly prepared clay it is more difficult to get the plasticity necessary for coiling. It must be left to the teacher to choose. If claywork is part of a larger project related to the neighbourhood, then to do the whole preparation in school will have great educational value. On the other hand, time and energy will be saved by buying ready-wedged clay, and it may be possible to get that locally. One might combine the two approaches—take each group to fetch and prepare a batch, but after that let them use prepared clay. At any rate, I shall outline the process of preparation for those who can tackle it.

Finding the Clay

Where does one expect to find clay if there are no local brick or tile works or pottery? There may be a disused works which will indicate deposits of which enough will probably be left for school use. The Rural Industries Bureau, the District Surveyor, someone with a wide knowledge of farming may be able to suggest a source. Local place-names, for instance Claypit Lane (in West Bromwich), Soggy Hole, and so on, will give indications, as will the children's own excursions and observations, once they know what to look for. The children will get a great relish from seeing their clay in the ground and helping to get it to the schoolroom, but it would be a pity to make a fetish of this or tire them with large-scale attempts at transport of clay. An excursion all together with a local farm cart, or even a barrow,

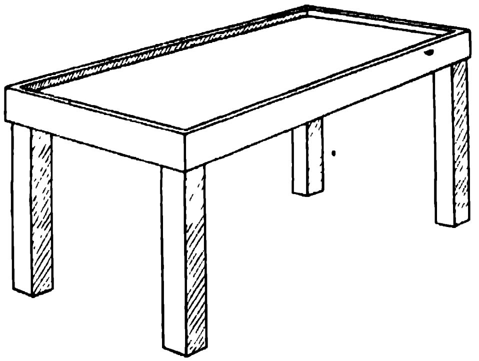


Fig. 14.—SMALL STURDY TABLE WITH WOODEN WALLS BUILT UP ROUND THE TOP. THIS WELL IS THEN FITTED WITH PLASTER AND LEVELLED OFF BEFORE IT DRIES.

will be a better outlay of energy.

Having got your local clay to the school playground, the next process is to make it workable. If it does not contain large pebbles or hard lumps, it may be quite usable for modelling as it is. But if it contains boulders or sharp stones, and is to be used for pottery, it needs preparation. It must be sieved and dried off to plasticity again.

For this you will need the following equipment:

At least two barrels.

Sieves, of 20 to 60 mesh (according to the size of grit you can afford to let through, and the energy you are prepared to put into sieving) (Fig. 15).

Very large, very stiff brush.

A length of rubber tubing.

Some pails, wide bath or tub, galvanized coal-bin.

Slabs for drying off clay that is too wet.

The best slabs I have found are porous brick which could be made to the size you want (perhaps 2 feet by $1\frac{1}{2}$ feet by 2 or 3 inches) and fired at a soft biscuit temperature. The number will depend on the room you can spare for drying. Your local brickworks may make these. Failing that, you can make plaster-of-Paris drying slabs yourself in this way: if you have a small table you can spare just for drying, build up its top with walls of wood slats up to three or four inches and fill this with plaster of Paris which will set into a hard absorbent table-top (Fig. 14), or build walls of a very thick clay in any space you have and pour in plaster (see Chapter on Carving) to make a movable slab. But it *must* be thick, 3 inches to 6 inches, or it will crack, and large pieces will pull out with the suction of the clay.

Clay can be stored for long periods out of doors, where the frost and the sun will weather it and help to make it plastic. Clay to be used straight from the fields should be sieved with plenty of water into the barrel. When it has settled, say overnight, siphon off

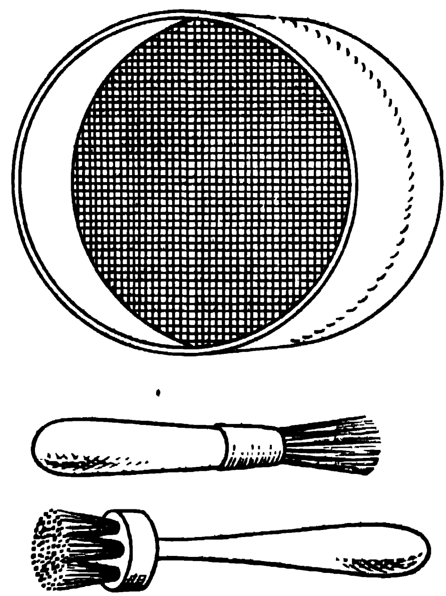


Fig. 15.—SIEVE FOR SLIP, AND TWO TYPES OF BRUSH.

the water with rubber tubing (Fig. 16) and lift or run the resulting slip on to the drying-slab. (Slip is clay of a soup-like consistency.) The process can be hastened by placing the same sort of slab (or a series of smaller ones) on top of the wet clay (Fig. 17). When sufficiently dry, the clay must be kneaded to an even consistency. For children's modelling this can be done by the children pressing it through their fingers and thumping it on a plaster or biscuit slab, or on a dry wooden table. For work which needs an even-textured clay, such as coiling, one has to be very careful to press out any lumps. The potters have a special way of preparing their clay, called wedging, but all methods are difficult with small children, who have not the needed strength. The purpose of wedging is to get the clay of even texture, to detect foreign bodies escaping the sieve, and to get rid of air bubbles which would blow up the ware in the kiln as the air expands rapidly with the heat. These air bubbles can be felt as hard knots under the hands.

If some better-prepared clay is required, the lump having been repeatedly thumped on the slab can be cut across rapidly with a wire and the cut sides banged together again. Or it can be trodden underfoot in a tub.

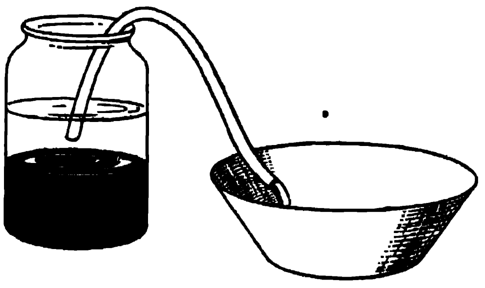


Fig. 16.—Siphoning off Water which has collected on top of a Glass Jar of Slip with a Piece of Rubber Tubing.

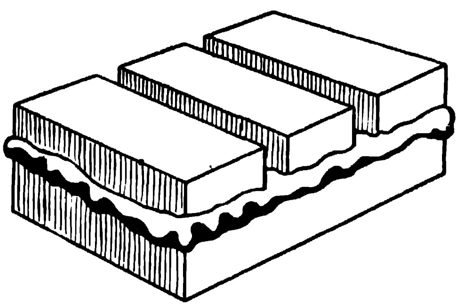


Fig. 17.—Clay drying between Soft Biscuit or Plaster Bats. Small Bats, as on top, are lighter to handle.

Indeed, the best method of pugging is the old Oriental method of tramping it by foot, and the children will love to do this.

Although its walls are considerably higher than we need, a galvanized coal-bin is a valuable container, because it has a little door to let out the slip. This can be closed and wedged round with clay while the clay is sieved over the top with plenty of water. The water collected on top is siphoned off next morning, and the slip will run out on to a prepared runway to dry off. In a classroom set-up it can be let out on to a soft biscuit slab and then rolled into a wide tinned bath. Let the children, two at a time, trample the clay with their feet to get it in condition for work which needs more plastic clay (Fig. 18). Meanwhile, the next batch is let out of the trap-door (or ladled out in basins if you are using a barrel or bin) and allowed to dry on the slab. When the first batch is tramped sufficiently, it is rolled into lumps and stored in the bin; this new lot takes its place in the bath for tramping. So quite a large quantity can be prepared in one half-day for use in the weeks ahead. A potter kneads his clay just before using, but this method will be

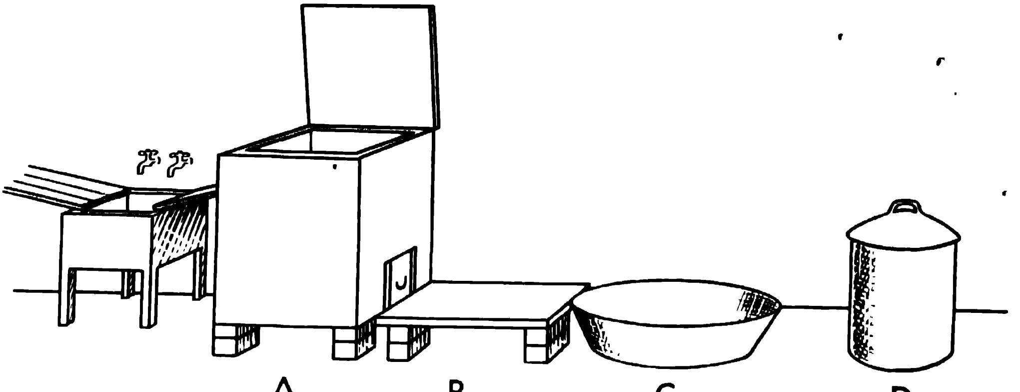


Fig. 18.—Water is mixed with Clay in the Bin (A), to a Slip, run on to the Drying Slab (B), kneaded by Foot in a Bath (C), and stored in the Bin (D).

found practicable if care is taken to *keep* the clay in condition. It is better not to knead on a plaster slab, because the suction pulls up small pieces of the plaster into the clay. For the same reason one cannot use an enamel bath for tramping, but galvanized iron or aluminium will do. If one plaster slab is used repeatedly for drying, it will become so wet that it will not absorb any moisture from the clay. Sometimes it is possible to arrange the drying slab over a stove or radiator and so have it drying off all the time (so long as the heat is not too great), or two slabs can be used alternatively, one drying as the other is used.

Range of Work with Local Clay

The type of work will depend very largely on the quality of the local clay you can find, if you get your main supply near at hand. Modelling can be done in almost any clay, and a mixture of sand and roughage in it improves it for firing. This is also true of tiles, which can get a coat of smooth slip over the surface if that is too rough for decoration. Coiling needs a rather plastic clay if it is to be really successful. If the clay will not easily coil, try variations of the pancake pottery described in "more advanced methods of shaping" (p. 35).

A Craft- or Clay-room in a Primary School

We have been considering the preparation and use of clay in the smallest available space in a classroom or all-purposes room. But conditions vary very much between country and city schools, and the new schools being built have infinitely better facilities than the old, so it is conceivable that the teacher may be fortunate enough to be able to choose the conditions in which she will work. If one can have a clay- or craft-room set apart, it is wise to choose a shed or old Army hut where clay and other messy work can be kept outside the normal classrooms. Stout tables with metal or plastic tops are best, a sink is very necessary, and a smooth cement floor which can be mopped up easily is an asset. All the clay equipment can be arranged against one wall.

All dirt is then carried back towards this end of the room and need not inter-

fere with other types of work going on at the other end.

Time can be saved if equipment wanted by every pupil has not to be given out every lesson. So such things as boards and rolling-bottles and rags (for damping) can be kept near the tables or desks. An old margarine-box hung beneath each table may be used to hold these (Fig. 19).

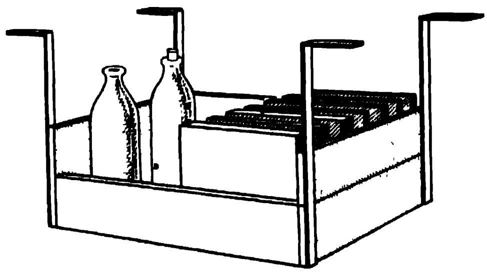


Fig. 19.—Margarine-box with one Plank removed for easier access. It is fastened under the Table with pieces of bent Metal, or Rope running through Screw Rings.

We have so far been considering classes conducted in an ordinary room under a static time-table. But, of course, the children will want to overflow out of doors (the french window or glass wall is indicated again), and handwork flourishes much more when the children are allowed to work as long as their interest lasts—which may be all day or all the week. Under such a free time-table clay activities can be going on at all sorts of times and in all sorts of places. Each child, after he has begun to find his way about the material, may tackle a large-scale subject, perhaps a port scene with ships and figures or a family portrait group, or any group may embark on such a project. Where time is given to go on until the job is finished, the satisfaction is much greater. Few children want to come back to a piece of work started a week ago, or the week before that, and so one finds the scope and scale of the work limited to what can be done in one period. A small child has no conception of how much he will be able to do in an hour, and he may well embark on more than he can finish. In a semi-free time-table, where one must do the regular subjects of reading, writing, and so on, it is a feasible scheme to devote all the "expression" lessons—singing, drama, handwork—in one week to singing, say, the next to drama, the next to crafts. This gives the project in hand (production of a little play or modelling a village) more coherence within the short memory of the child, and enables some rather bigger jobs to be undertaken.

Normally, since fairly speedy direct work is the aim in clay modelling, there is no need for a damp cupboard, that is, a cupboard where a model can be kept damp; but in the case of a project lasting a week, it may be necessary to keep the work in hand damp. In this case, lift the model on its board on to a shelf and pin a soaking-wet cloth to the shelf or wall above, so that it hangs along the front and sides. Or the whole can be covered with a piece of plastic material (which is light and not likely to damage upstanding parts) weighed down at the edges.

CHAPTER SIX

DECORATION

Types of Decoration

CLAYWORK can be decorated—

(1) In the "leather-hard" state (when it is dry enough to stand up by itself but the surface can still be impressed): (*a*) by *incising*, as in Bronze Age beakers, or with dots or strips of *clay pressed on* as in mediæval English jugs; (*b*) with *slips* as in English slipware.

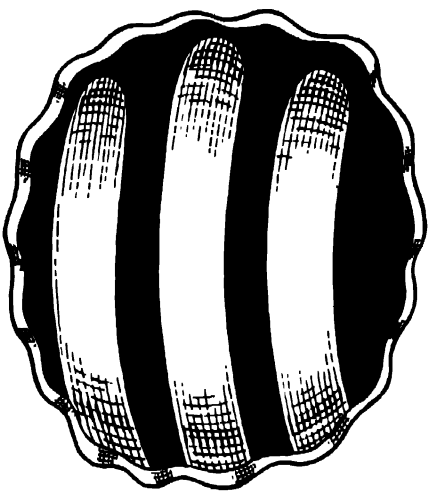
(2) In the biscuit or once-fired state
   (*a*) on the clay before glazing as in most Corean ware
   (*b*) on a white opaque glaze before firing as in Delft ware.
   The colours used here are *metallic oxides*.

(3) On top of a fired glaze, with potters' *enamel colours* as in English painted china.

There are some other variations, but these are the main types.

To colour clays or slips there are five or six colours found naturally in the clay in various parts of the world. The underglaze colours are metallic oxides, and hundreds of combinations of them are used to give the pottery industry its sophisticated variety of decoration. They present a bewildering choice in *Wenger's Catalogue*; I would never order, for example, "salmon pink" or "turquoise blue" for children or students. The combination of the various chemicals in such colours are trade secrets, and you do not know what you are using, and so cannot learn from the experience.

Even the pure metallic oxides which are suitable for painting with at later stages are not appropriate for the Primary School, because they look like a black or grey powder, and it needs considerable experience to know how much to use, and what colour the result will turn out. Opaque Delft glaze



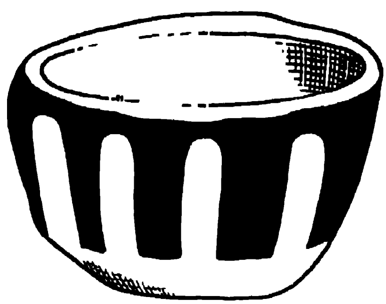


Fig. 20.—Thumb-pressed Dish and Pot, coated with black Slip. The Dish is incised direct with a Finger, the Pot with a Pencil-end as a Tool.

might be used where glazing is done, but the introduction of painting upon it is open to the same objections, and to paint on this blotting-paper surface needs a co-ordination we cannot expect from a child of this age.

So, it seems sensible to keep decoration for the time being to that which can be incised or impressed directly on to the clay, or put on with slip. This limits the colours, but a large range of colouring may well be confusing for the child. If he has the choice of bright colours in his painting, he will accept the duller colours of clays as natural to them without feeling frustrated.

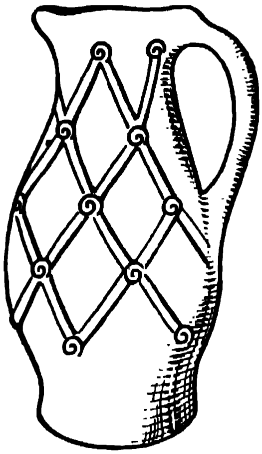
Incising and Impressing (Figs. 20 and 21)

The child will probably discover for himself the fun of clay additions for arms, legs, hair, crown, clothes, and so on. Clay modelling is essentially a process of building up, and the opposite to carving (see Chapter IX). The child will probably also incise as naturally as he draws, using a stick, a penknife, or the butt end of his pencil to impress repeating dots. There is little need for special tools at this age. Fig. 20 shows very simple examples of incised work, Fig. 21 examples of impressed decorations.

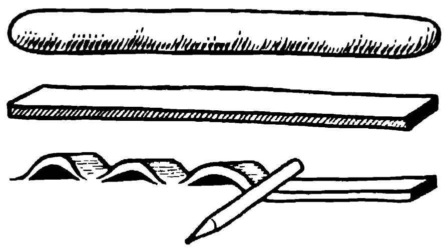
Decorations with Slips (Figs. 22, 23, 24, 25, and 26)

The possibilities of slips* are outside a child's experience, and he will probably need to be shown how to use them.

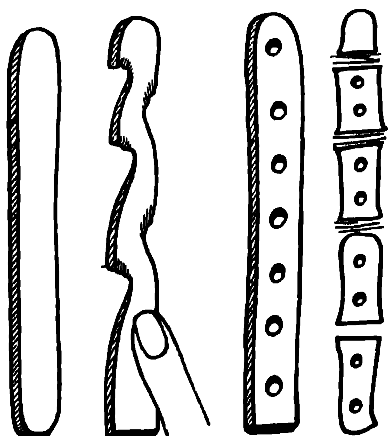
If, as is most satisfactory, you find a local earthenware clay, it will probably be coloured. The pure white clay of our china has had all the iron extracted from it by being passed over magnets.



Type of Mediæval Jug decorated with bands of Rolled Clay impressed in a Diaper Pattern.



A Sausage of Clay can be rolled flat and pressed on the surface with Finger or Pencil like a Ribbon.



Surface Pattern in Clay. A Roll can be Finger-patterned or notched with Pencil-end or side.

Fig. 21.

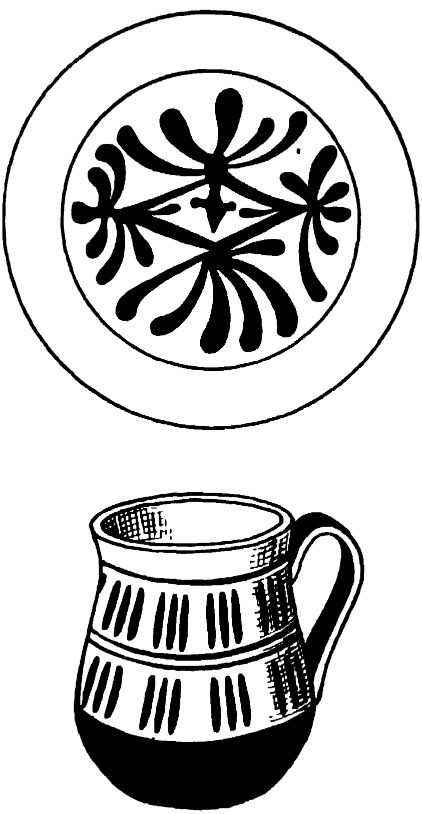


FIG 22.—SLIP DECORATION. AT THE TOP, A DISH WITH SLIP-PAINTED CENTRAL PANEL BY MODERN PUEBLO INDIANS OF NEW MEXICO. UNDERNEATH, AN EIGHTEENTH-CENTURY STAFFORDSHIRE JUG OF BROWN CLAY DIPPED IN WHITE SLIP WHICH IS THEN SCRATCHED OUT IN A PATTERN OF SIMPLE STROKES.

In school pottery there is far more reason for taking advantage of pleasant variations in the body than of striving after a high degree of finish. Some country potteries, such as Lake's of Truro, allow this pigmentation in the clay to give variety to a simple glaze, and achieve very lovely effects with the utmost economy of means.

With your coloured clay you can combine first one, and then a range of coloured slips. If your clay is red or brown, you will get a satisfactory range of colours with a white slip and a black slip. The white you may be able to get locally either from a pottery or out of the ground, but if not, you can order white ball clay and sieve that into a slip. Black slip can be made by adding to your body clay—that is, the clay you are using for the model or ware—up to 30 per cent. of black basalt. You will find that the different methods of decoration give a good variety with these three colours, and more will probably be confusing for the children. But, if you have explored these thoroughly and want to extend, green slip can be made by the addition of green chrome, and yellow by ochre.

Wherever possible, the slip colouring should be added to a base of your body clay. Otherwise, the body and the slip on it will contract at different rates and the slip will simply peel off. If you are not a potter yourself, it will be much simpler for you to try to find a local pottery which uses, for example, a brown body and a white slip—and order the clay and slip from them, as you will know then that the two will hang together. If only a coloured clay is obtainable locally, then you can add black basalt to that and have a range of two which " fit " one another.

Equipment for making coloured slips.—Black basalt, 8 lb.; any of the following, green or yellow chrome oxide, 2 lb.; red iron oxide, 2 lb.; the sieves and brushes already described; jam jars or other jars for storing slip. Large soft brushes are supplied by such firms as Wengers for painting with slip, but with young children *large* old paint brushes will do, so long as they have not entirely lost their points.

The making and using of slips might be introduced to children when they are about ten years of age. It opens up

a new field of decoration, as will be seen.

Slip is prepared in this way. Clay broken down into lumps is squeezed through the fingers in a bowl containing a few inches of water—if the clay is allowed to stand in water for some hours it will disintegrate and lose its plasticity. This mud-like mixture is then sieved with a stiff brush (and more water if necessary), *along with any colouring matter,* into a jar or bowl. If the slip is too thin, it must be left to stand and the water siphoned off (see Fig. 18). Some of the colouring oxides are heavier and tend to fall to the bottom. In any case it is always wise to stir a slip round well by hand or by a stiff brush before using it. One learns to know the thickness of the slip by the feel of it in one's hand. Large jam jars are very suitable for storing the slips. The class can make tiles to cover the

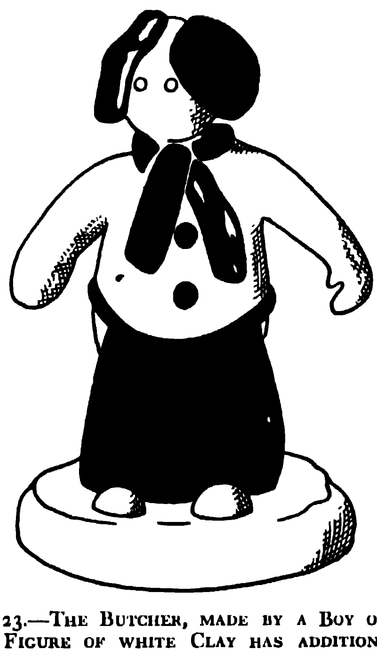


Fig. 23.—The Butcher, made by a Boy of 10. The Figure of white Clay has additions of Hair, Scarf, and Apron in brown Clay.

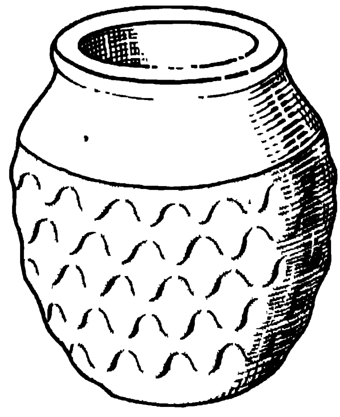


Fig. 24.—A Coiled Pot of brown Clay, dipped to the Shoulder in white Slip.

jars and keep out the dust. The name of the colour is put on each tile in slip.

Ways of using Slip

Since it is advisable to put off the use of tools as long as possible with the young child and allow the direct handling of the material to develop sensitivity in the fingers, his first introduction to colour in clay should be combining clays which he can handle. If some of your slip is poured on to an absorbent brick or plaster board, it will dry off in a few hours and be of the consistency of the clay you use. Then the child can add pieces of black or white to his model or tile. This will encourage a decorative rather than a naturalistic treatment.

Parts of the model—the hair, the shoes—can be dipped in the soup-like slip, or spots, stripes, and so on can be put on animals by smearing with a finger dipped in the slip (Fig. 23).

Pots can be dipped in slips for contrasting colour, but as they may take up so much water from the slip that they flop down in a soft heap, it is safer only

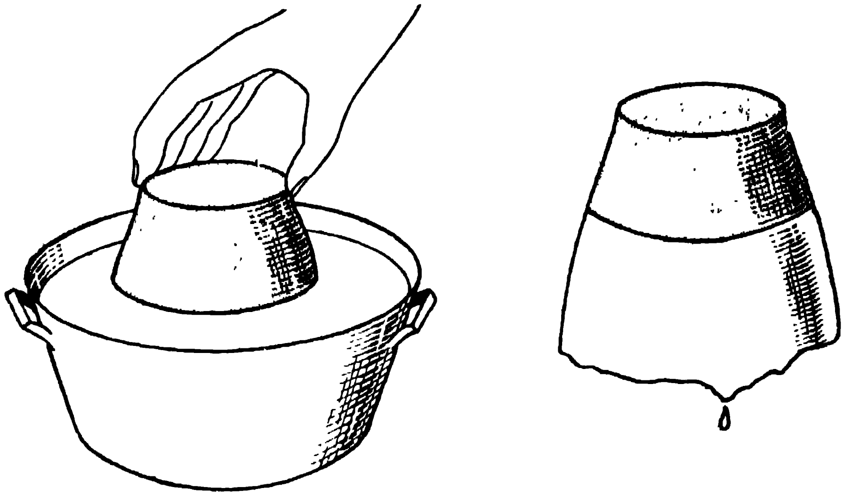


Fig. 25.—Method of dipping in Slip, holding by the Base and shaking surplus Slip off the Rim before turning right way Up.

to dip part, the rim or the shoulders (Figs. 24 and 25).

Tiles can be dipped all over by pouring the slip into a pie dish or toffee tray and slipping the tile along the surface quickly (Fig. 26).

Tiles so dipped are left to dry for half an hour if convenient, but it is much more likely that the shiny smooth surface will be irresistible and the child will want to get to play on it straight away. This should be done, in the earlier years at least, straight with the finger, and practice in finger painting will give him confidence, and a sense of the space to be filled. Fortunately, if the first scribble is a failure, it is easy to wipe the surface smooth with the fingers or with a sponge and try again. If a smoother surface is desired, the tile can be dipped again, but not too many times in close succession, or it will get too soft to hold.

As another development, this slip surface may be incised with a wood spatula which gives a cleaner, harder line and smaller detail than the finger smudge. This, again, presents a better surface if allowed to dry till near leather-hard, but this is not always possible

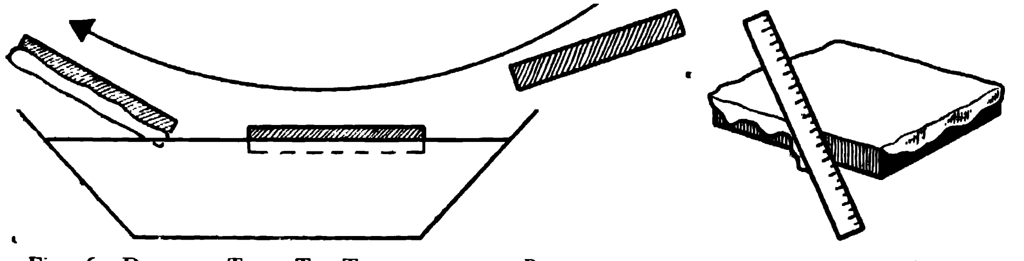


Fig. 26.—Dipping a Tile. The Tile held by the Base is swept downwards, along the Surface of the Slip, and up in one movement. The Slip dripping along the edge is then sliced off downwards with a Ruler or Knife.

under classroom conditions. As soon as a small tool is introduced, there is a tendency towards pencil-fine drawing which is out of place with a coarse material like earthenware clay, so the few tools used should be large. It is characteristic of this age group to make use of anything which lies to hand, and the butt end of a pencil will serve for incising. It may be necessary to point out that a tile or a plate, unlike a picture, has to be looked at from any side. This is not to say that it cannot be decorated with an animal or a spray which is obviously more interesting from one point of view, but that the lines and the balance of two colours must be pleasant enough in themselves to stand as a decoration when one looks at it upside-down and cannot appreciate the subject proper (Figs. 27*a*, *b*, and *c*).

Another type of decoration for tiles is like that done in paste-comb patterns and can be carried on after the child has had practice in that medium. The tile is slipped in the same fashion and the surface is stroked with a cardboard or metal " comb " cut by the child. On the first tile several attempts can be made, sponging the surface between each trial, and this sponged surface makes quite a pleasant background for the firmer comb strokes.

Fig. 27a.—German Tile. These would be produced in numbers by stamping, but the original from which the die was made would be incised.

Fig. 27b.—Mediæval Tile. The dog has the sort of simplicity we might expect to find in a child's work.

Painting with Slips

The other use of slips is on a thick soft brush in paint strokes. The slip is so thick and is absorbed so quickly into the leather-hard body that it is impossible to get a long or an even line. The child can gain familiarity with this sort of stroke by dipping the brush in slip and painting on the wooden table or plaster slab.

Fig. 27c.—Spanish Rectangular Tile, with a lively Cow.

It is never a good plan to get the children to paint first on paper a design or pattern they are to use in the clay or in any other medium. All painting and pattern-work is important because it develops a sense of rhythm and spacing in a medium—paint—which is easy to use and does not inhibit by the need for acquiring a technique. Having gained confidence and sureness and an inner sense of pattern, the child will bring these qualities to his new problem in clay. But the effect is indirect. It is no use painting a pattern or a picture in paint and trying to copy it in clay.

The stroke made with a pencil, or more obviously with a pen, is different from the kind of fat oblique stroke made by a brush full of slip. Therefore, to practise a pattern in paint and try to transcribe it into slip is impossible, illogical, and frustrating to the child. Plenty of practice can be had by "scribbling" in slip with the finger or brush on a surface which can be wiped clean easily. This is a principle of the greatest importance. The stone-sculptor's model in clay, the painter's sketch in pencil, are the far end of a long development, the telescoped shorthand of a master. Children can only learn to design in clay by using clay, or in wool by using wool. Fig. 27 shows examples of patterns that fill the space well.

CHAPTER SEVEN

GLAZING AND FIRING

Colouring Unfired Models

IF you have no hope of firing and so glazing the models, should the children leave their work dry and white or should they paint it? The purist sees painting as a desecration of the clay. But with the under-twelves it seems best to leave it to the children. Their sense of form as such is not developed, and they may well be dissatisfied with the dead white of some clay. If they spontaneously show a desire to colour their models with powder paints, and if this colouring makes the objects more suitable for their purpose, they should be allowed to colour them.

But a really unpleasant appearance is obtained by covering painted clay with a coating of varnish in imitation of glaze. Firstly, the texture of the clay is destroyed and replaced by a treacly surface. Secondly, the yellowish varnish spoils the bright powder colours the children will choose. Thirdly, there is an element of falsity in counterfeiting glaze, and varnish invites comparison whilst serving none of the purposes of glaze—that is, to provide a hard wearing surface and keep it watertight.

A better way is to provide a clay pleasantly coloured in itself, which will dry to a pleasing texture, giving interest to lights and shadows. If you are provided with a white clay or have to use it for other purposes, you can colour some for unfired modelling with the red iron oxide, blue calx, or green chrome.

Glazing

A good deal of satisfactory pottery can be done with younger children by biscuit-firing only. The models can be left as terra-cottas. Some pots which are intended to be used can be given a coat of wax polish, to give a shiny surface and prevent dirt sticking. Wax floor polish is suitable, or beeswax melted with a little turpentine rubbed well in. It gives a clean, pleasant surface and serves for cake or biscuit dishes, ashtrays, candlesticks, and plates, but it will not hold water, and it is a makeshift method.

If you can fire up to a temperature of 900 degrees Centigrade, you can glaze your pots. Models are very often best left unglazed—so you can concentrate on pots, if kiln space is in demand.

A glaze is really a glass to give a hard waterproofing surface, and so you want a substance which will flux below the temperature at which the body will flux and lose its shape, and one which is sympathetic enough to the body to unite with it. If you put glaze on to a biscuit-fired surface which is soft and underfired, the glaze will peel off when fired, and if you put it on to a surface which is overfired (as often happens on one side of the pot with primitive methods of firing), the water in the glaze will not be absorbed into the surface, and very little glaze will hold on there.

Most of the glazes used in pottery are complicated mixtures in which each

ingredient plays its part. It is better never to buy a proprietary "standard glaze," or anything like that. First of all, you do not know what is in it, so you cannot explain to the children what is happening. If it is not suitable to your body clay, you do not know what is wrong, and you are powerless. To start your children off on complicated glazes is like putting them to the sewing machine before they can use a needle. We must be on our guard against this sort of thing in teaching pottery, more than in almost any other craft, because the present-day pottery and china that most of us know and use are the products of a complicated and highly industrial system, very far removed from the simple beginnings. It is in the rural potteries, not in Staffordshire, that we shall find the methods of production from which we can select those appropriate and possible for schools. There, the old methods of pressing and wheel-throwing are used, instead of the jigger and jolly work and casting used in large-scale industry.

If we are really concerned that the crafts should have educational value in two senses, that the children should learn about how things are made, and that they themselves should learn to experience the thrill of making, then we must keep the educational end, not merely the production of objects, uppermost, and reduce all processes to successive steps which the children can understand.

We can approach the more complicated forms of glazing which they may learn in the upper school by use of one simple substance which will form a glaze. Borax and a few other substances melt at temperatures we may hope to reach, so begin by using borax or boracic frit. (This can be obtained from Wengers, Stoke-on-Trent.) Borax itself is soluble in water, which leads to complications when the glaze is drying, so we use it in the form of a frit that is mixed with other substances, heated to fusing-point, and, when it has cooled, ground to powder. Glazes are usually put on in the form of a liquid of cream-like consistency. The powder is put through your finest sieve with plenty of water, using a stiff brush. The sieve used for clay (see Chapter V) is suitable if it is cleaned carefully, but a finer one is better, for if too many large remnants of clay are washed through, they may spoil the glaze. It is best to leave the sieved mixture overnight and siphon off the water the next day with a rubber tube. The glaze should feel like soup when it is stirred, but it can be tested for the right consistency by dipping in a piece of biscuited clay of about the same thickness as your pots. If only a very thin coat of glaze is left on when the water is absorbed, then it is too watery. Some of the glaze is absorbed into the body when it fires, and so if it is too thin none may be left to form the glassy surface. If it is too thick, a heavy deposit is left which cracks and flakes off as it dries. Into this liquid glaze you may dip models, plates, pots in the biscuit state. The base and some little distance above it is left unglazed, so that it will not stick to the floor of the kiln.

Tiles are glaze-dipped in the same way as they are slipped, by sliding them along the surface. Then the sides can be trimmed downwards with a penknife (Fig. 26).

This glaze gives a clear glassy surface. As all the pottery of which we

are speaking will be hand-made, it will already have a surface interest in the finger-marks or coils. It will pick up some colour from the body of the pot and (unless the body clay is white) it will probably not need colour added; 1 to 3 per cent. tin oxide added will turn it milky. Complicated glazes are not for the Primary School, and even without any glazing, fired pots and models can be very satisfying to the children.

The Mediæval Potters who used a clear yellowish type of glaze on pilgrim bottles, used to scatter in a little copper oxide or iron, perhaps after noticing how the glaze picked up "impurities" in the body. The children may be interested to see this, and learn about the use of running colour in glazes, but it is only pleasing on a very smooth surface. I put impurities in inverted commas because it is an instance of the completely different outlook of the large section of industrial manufacturers from that of the hand potters. The manufacturer is aiming at technical perfection, a standard make, which can be exactly repeated. The rural and the hand potter can take advantage of variations on the clay or glazing which give it interest, and can, in consequence, keep the shape very simple, and decoration very limited. Children, like primitive man, have an exuberant sense of pattern, and plain surface has the attraction of a stretch of untrodden snow. Once having the simple techniques of decoration they may go too far and decorate everything, but this is nothing to worry about (Fig. 28). They are practising a new craft and only after repeated trials can they select the kind of pattern that will be appropriate. After the interest in applied art and heavily

Fig. 28.—Eighteenth-century Staffordshire Plate. This is the type of exuberant over-patterning which one finds in Children's work.

decorated surface of the nineteenth century, we see beauty in simplicity and restraint. But the way to deal with the desire for pattern at this age is not to repress it, but to give it free rein, and to get it out of the system. In the 'teens they will come, with some help, to see the form rather than the surface.

Firing

As was pointed out earlier, there is a considerable place for clay-work in the Primary School, even though it is not possible to fire the results. But obviously, it is much more satisfactory if you can make an attempt to show the children the process of firing. If you get your clay from a local pottery or tileworks, it may be possible to rouse their interest sufficiently to have your things fired in a corner of their large kiln. This will have the advantage of ensuring that the kiln treatment and temperature are suitable for the clay. If the kiln is taken up to a temperature higher than your clay will stand; the

pots will first warp and eventually melt into a pool which cools as a shapeless lump. The only way to find out what your clay will stand is to fire it. Normally, one would suit the firing to the clay, but if the use of kiln space is offered and not the appropriate clay (you might, for instance, be allowed to put some pots in the local art school kiln, firing possibly at stoneware temperature—about 1,300 degrees Centigrade) you must adapt your clay or find another that will respond to that temperature.

But, even though here is the opportunity for this more professional sort of firing (which will give a higher rate of successful results), the children must have the opportunity to see and to participate in firing on a much simpler scale, so that they can grasp its principles. There are several primitive methods which you can try out in the playground or field.

Leach tells of Nigerian firings where pots are heaped up in the open air and covered with grass, which is fired and added to till the ashes sink down to cover the pots and hold the heat in. It is possible to fire our pots in this way, but it has to be carried out for hours and hours, and the breakages are apt to be very high. It is even possible to fire little models in an open house-grate by heating them slowly in a gas oven and when they are really hot transferring them with tongs to the centre of a red coal fire. But the garden kiln works on the same principle as a larger-scale one and can be constructed by children.

Simple School Kilns (Figs. 29, 30, and 31)

The two main divisions of feasible school kilns are the chimney kiln in which the flames go up, and the boiler type in which they travel lengthwise. To sink part of the kiln in the ground preserves the heat and protects from cross-draughts. A pit to stoke from means more digging, but is useful. An old air-raid shelter may prove a suitable site. It is sheltered and probably has a concrete floor.

The first firing, which hardens the pots from the very dry and fragile " white hard " stage, is called the biscuit, in which the pots come to the state of losing their chemically combined water. For this the pots can be set, one on top of the other, all touching. But they should rest on their steadiest part and the flames should be free to circulate inside and out.

In a glaze firing, the glaze has to vitrify and harden, so the pots must not touch or they will stick together when the glaze is molten on their sides. To prevent any glaze which runs down from sticking to the base of the kiln, it can be sprinkled with fired sand.

We need a trench to hold the fire and a chamber to hold the heat in round the pots. The trench can be built level or with a slight slope upwards, to encourage the up-draught. It can be roofed with bricks or with sods laid on iron bars.

Simple Flower-pot Kiln without Bricks (Fig. 29)

This is a very simple kiln which shows the essential principles and needs little in the way of materials and no heavy work, so it is suitable for small children. It is merely a trench in the ground with a slope down at one end. The centre of the trench is roofed with sods and the far end has a few old iron bars laid across to support the pots, and

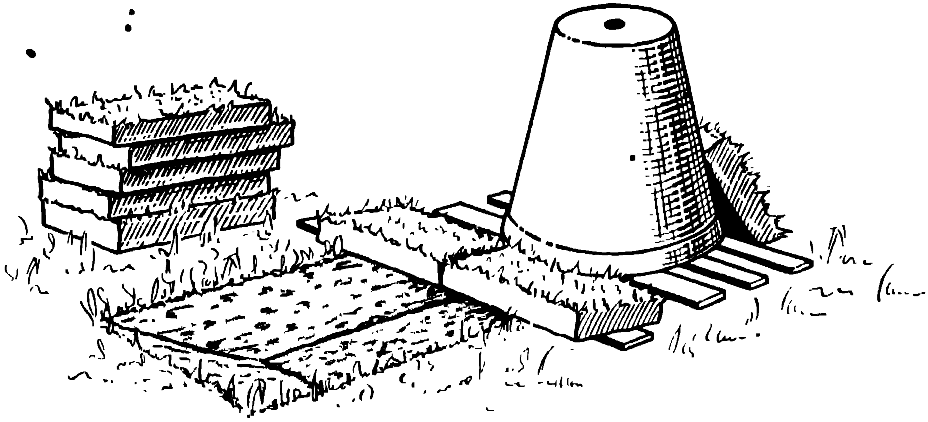


Fig. 29.—Flower-pot Kiln.

a very large flower-pot placed on them upside-down to serve as a kiln chamber. This is then banked up with sods all round to keep the heat in. The flames go up through the chamber and out of the small hole at the top. This can be fired with wood, preferably resinous, or wood with coke added when it is drawing well.

With these primitive kilns in which the flames actually go round the pots one must expect a certain amount of burning and blackening. It is not helpful to quote exact sizes while suggesting that you begin with scrap material to hand. Your size will be dictated by the size of the largest flower-pot you can find or the number of bricks available. In professional kiln-building the relationship of sizes is very

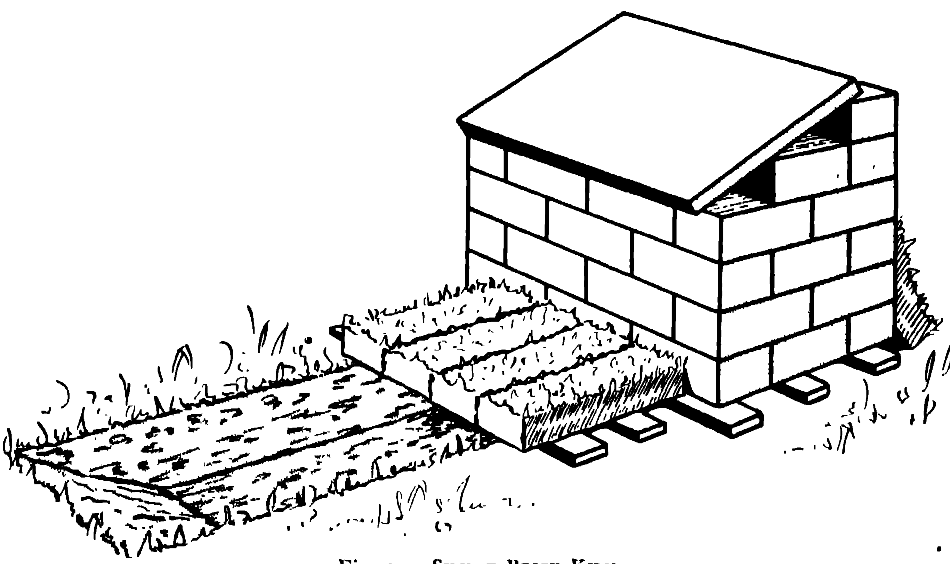


Fig 30.—Simple Brick Kiln

important, but here it is the simple principles which have to be grasped—tunnel for draught, padding to conserve heat, and so on. With one so simple as the flower-pot kiln, the children can fire it once without banking it up with sods, and the next time with sods, and see the difference. A good draught is the biggest factor in getting up the heat, so all these kilns are improved by the addition of a chimney. An old chimney pot may be found lying about which could be fitted to the larger kilns. With the smaller a drain tile, broad end down, or a four-square chimney of bricks set on end will help. At first we are all experimenters together, and improvisation is the key word, at least till the possibilities are known.

A Simple Brick Kiln (Fig. 30)

A kiln similar in type to the flower-pot can be built of bricks. Firebricks stand much higher temperatures, and so are more practical, but if they are not obtainable, ordinary bricks can be used. Four slabs of fireclay to line the chamber, at least part of the way up, will keep the bricks from cracking so soon. You can probably have them made to your size at a tileworks, or buy some slabs used for shelves or lining at any kiln works near, and fit your size in with them. A square or rectangular chamber is built with two sides resting on the sides of the trench and two on strong, flat iron bars. A discarded ventilation grid might be salvaged for the base, but a few bars laid across will do quite well. The walls can be built up to any height, but this kiln, too, is packed from the top, so the children must be able to reach down. The back wall can be built higher and the angles of the bricks filled up with the fireclay used for cement. Then a slab of fireclay is laid on for a roof leaving a small outlet for the flame, and sealed up for each firing with grog and water.

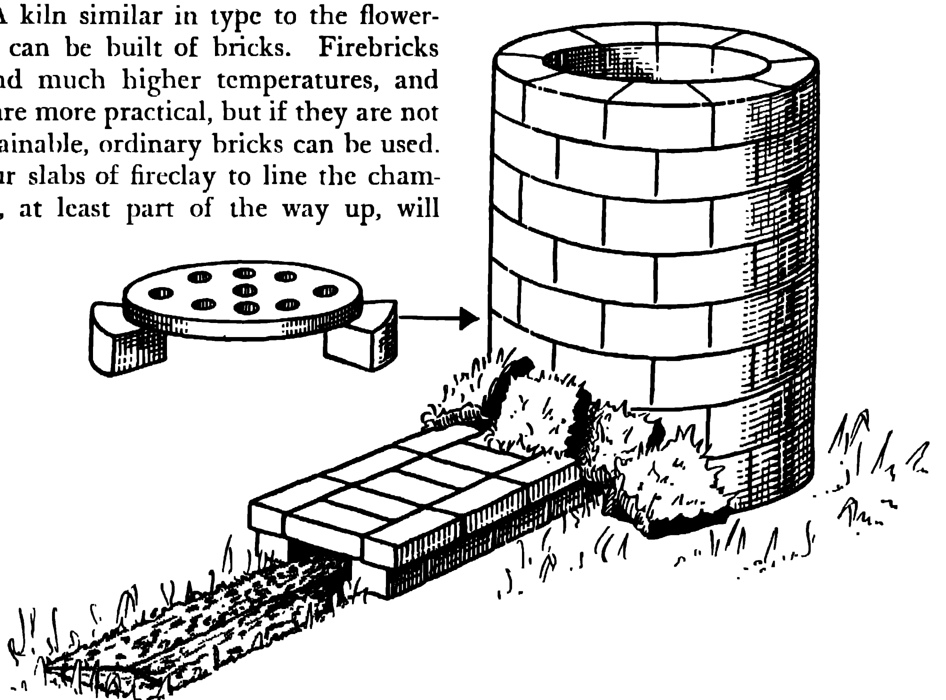


Fig. 31.—Circular Fire-brick Kiln shown without its Cover. The Pot rests on a circular Fireclay Base pierced with holes, supported on two protruding Bricks. The level in the Kiln is shown by Arrow.

Each of those experimental kilns is open to all sorts of adaptations. For the cement, shake loose fireclay into a gallon of water in which ½ lb. of water-glass has been stirred till the mixture is of mortar-like consistency. It must be very well mixed.

CIRCULAR FIRE-BRICK KILN (Fig. 31)

A simple sort of circular kiln for wood or wood and coke burning can be built of firebrick made by the Morgan Crucible Company, London—to fit together into a circular shape about 14 inches in diameter. This circular kiln can be made by using ordinary rectangular bricks and filling the triangular spaces with fireclay. A small tunnel protects and directs the heat; by allowing three bricks to project (Fig. 31), a support is made for the floor of the kiln. If the support is a circular slab of fireclay, pierce it with 1-inch holes. The heat travels up through these holes, around the pots, and out at the top. The roof can be an old dust-bin lid with a centre hole. Bank it with sods to keep in the heat. This kiln is packed from the top. One advantage of this kiln is that by means of protruding bricks, or by boring holes for notches to be fitted in at various levels up the sides of the kiln, shelves can be fitted as for glaze firing.

PACKING THE KILN

Tiles can be stacked on top of one another, but if they have been slipped with white it is better to turn two white surfaces together. A red clay resting on a white will often mark it with iron.

Bowls can be stacked one inside the other, but beakers should have a piece of old crock as a break to keep them from fitting too tightly.

Remember the ware will often expand a little, then contract a great deal, and you may find that fitted beakers become so firmly wedged that they never come apart. Be sure the tiles, bowls, etc., are *dry* before they are put in the kiln.

PROCESS OF FIRING

Always spread your firing over as long as you can. A whole day is not too long, and you will probably find that sometimes you end by sitting up all night! The rural pottery kilns are often fired over two days at least, and take a long time to cool. In biscuit-firing especially, the warming up must be slow or the pots will crack. The first stage is "smoking," and here the warm air circulates among the pots and drives off any dampness left about. It is after this has been going on for some hours that the cover or door of the kiln is finally sealed with a grog of fireclay mortar. Then one can set about getting up a good heat gradually. With wood-firing, burn the easy-burning light wood first, then logs slower to burn, with some coke added. The idea is to keep the heat steadily increasing, adding a little more wood at frequent intervals without greatly disturbing the fire. With the primitive types of kilns that have been suggested, there is practically no danger of overfiring. The problem is to get up to a heat that does truly "fire" the pots. Professional potters work with cones which turn over at a certain temperature and so register the heat. But with primitive kilns one can only hope to approximate to a red heat. With the last three types of kiln a spy-hole can be left about half-way up along the kiln. A piece can be clipped off one brick and a stopper

made to fill the hole every time it is opened. The red glow of biscuit temperature will be recognized with experience, but models can be fired hard enough to please the children at considerably below this temperature.

Children are intensely interested in the kiln and its firing, and even if they do not succeed, they will have gained experiences that will make history more interesting. The pots of the Stone Age people, the potter's wheel of the Egyptians, the lovely vases of the Greeks, will all mean more to them because of their attempts at pottery. (See History Charts I, IV, V, VI.)

CHAPTER EIGHT

CLAY AND OTHER MATERIALS

WE have been speaking of clay used to complete the whole piece of work—modelling, pottery, or whatever it may be (except where we suggested that children would spontaneously colour their models with paint). In the Primary School children will just as spontaneously use a combination of different materials—wood, scrap-metal, card—to get the effect they want. But after ten or so, when they begin to approach this work as a craft, and want to improve their technique in order to achieve what they wish, it is more helpful to concentrate on *one* material than on many. But this is not true until the new attitude has matured naturally in the child. So in the earlier years we have to provide many materials, and to expect them to be used in all sorts of strange combinations.

These different media may be provided as part of the normal equipment of the room for the activity period, but if not, then we must collect them. If such a collection is started by the teacher, the class will bring additions to it and probably in time keep up the "stock" entirely by themselves. Some schools make a point of not providing even the beginnings, but of waiting until the children see the need for something and then saying, "Well, you see if you can find it, because if you can't you will have to make something else." Such scrap materials are odd bits of wood, scraps of metal and nails, bits of cardboard and coloured paper, tinfoil, match-boxes, match-sticks, corks, reels, and so on. Almost anything will do. Such a collection is much easier to deal with if old orange or margarine boxes are provided, and one is kept for wood, one metal, one match-boxes and small boxes, etc.

A child who wants to make a boat may choose to make it of clay, with a stick for a mast and a paper sail. Children who want to make the things they have seen or heard about should be encouraged to the full because they can appreciate better the essential points about any objects they have tried to make—boats, steam-rollers, etc. Country children will make villages and farms, town children parks, railway stations, fire-stations, etc. Nearly every child makes houses of different kinds, furniture, dolls, carts, etc. Many things can be made entirely of clay, but the children should be allowed if they wish to turn to other materials for additions. A model village may have dry grass added for a thatched roof, small pebbles for a cobbled path, or match-sticks stuck in clay for railings. The young child may well pick up some leaves and want just to hold them together to make a tree. Leaves may be tied together or fastened to a stick with thread wound round and round, but very often, a lump of clay or Plasticine provides just what is needed. The trunk is built up

in a high cone and the leaves stuck in. To use leaves as a symbol of trees is indeed rather a literal interpretation; children who have been surrounded by lovely or interesting things, such as shells, pebbles, scraps of metal, will construct many fanciful objects to illustrate their make-up stories and plays. One child made, for example, a "tree" of clay and shells. The dragon (Plate III) shows a boy's sturdy yet faithful use of bottle tops, buttons, and wire.

When to provide clay only and when to provide all the suggested scrap materials must depend on the organization of the class. With a large class, in a rather short period, it is sometimes not worth while getting out all the necessary boxes and encroaching on the limited time by the moving around and pauses for selection which are really necessary. So, generally speaking, one should use a large range of materials when there is a longer time available. But there is one point often overlooked. It is usually more profitable to use all the "art and handcraft" periods for clay work for some time, and then to change over and use them all for painting for a week or two, then for carving or something else. The children then get into the way of using one medium and feel at home with it. They also become familiar, through day-to-day use, with where the things are kept and how they are to be put away. If painting is started one day, and they are shown how it is given out and where those things are stored (because one must have a system with a large class in a confined space), and in the next day or so they are introduced to a completely new set of equipment and where it is stored, and then to yet another set, it is small wonder if confusion results. Quite apart from these practical considerations, the children work better when they are so familiar with materials and tools that they have no hesitation or uncertainty. After a gap when no work has been done with a particular material there will be some doubt and forgetfulness again, but this will disappear if the subject is taken on a few consecutive days. This is presuming that a set time-table is at least partially adhered to. Where all the art and handcraft is done in free activity periods, or where a project is going on all the time, all the materials will always be available.

The Necessity of providing Many Materials

The really essential thing is that the children should have a *variety* of materials. If all those mentioned cannot be provided, then a balanced variety must be found. The children should have some soft moulding material, some hard cutting material, obviously colours, and perhaps less obviously—but quite as necessary—textures. The type of construction with several materials we have been describing is closely related to picture-making in several materials, or to model-making, and may or may not be truly creative work. It is not, of course, a craft proper. We reserve that word for a genuine attempt to create in terms of a material, which is a different thing from having an idea and hunting round for the material in which to convey it.

Continuity in Handcraft

The scope of this book is the Primary years but, of course, the child is one and the same in essentials through the

years, and education is one, and we can never speak of one age without looking backwards and forwards. In the earlier Primary years, the teacher will be doing a great deal if she provides the materials and gives suggestions and encouragement. But the time does come when every child wants, not only to make, but to make well; to make, not a toy jug, but a real jug which is practical for holding and pouring and which can be used at home. This desire may not become the dominant one until after the years we have been considering, but all the simpler techniques of clay-work—which may appear to take up a disproportionate place since they will be used only in the last Primary year or two—do lead on to this serious and satisfying work, which is possible for boys and girls in later years. The next chapter deals with a form of handwork the nature of which is complementary to that of clay.

CHAPTER NINE

JUNIOR CARVING

The Value of Carving

BEFORE we introduce any material or subject in school we ought to be clear what we hope the children will gain by it, what effect we expect it to have. We said that clay took easily the impress of the forming fingers and was the ideal material for imaginative work in three dimensions. The values of carving are quite different. Here we have a number of hard materials which have to be cut, scraped, or chipped; which require patience to work with; while the finished article takes much longer to produce.

Carving, perhaps, makes a particular appeal in schools where there is no chance to fire a kiln and so make clay work permanent, but apart from this, the virtues of carving are complementary to those of clay work. For this reason it is especially valuable for two types of child—those who never fully work in three dimensions in clay, who tend always to think in the "round as a penny" terms; and those who are too clever at modelling and become facile just because clay is so easy to mould. This second manifestation is more likely to appear at the stage of the changing vision when there is the growing interest in natural forms. The child who can model a very fair representation of a difficult subject may be praised for that alone at home and by his class mates, and, what is more serious, may become content with his work. But if this work is only a naturalistic representation, however clever, it is no more than a three-dimensional photograph. It is only when it contains a thought, an interpretation of the subject, and is bound into a whole by the qualities of design, that it is on the road to being a work of art. Hard materials for carving give us, firstly, three-dimensional shapes which invite three-dimensional treatment and so largely avoid the flat approach which is still just possible in modelling; secondly, they are impossible for a child to carve naturalistically, and so the emphasis is moved to design rather than representation; and thirdly, they present a really hard resistant surface to the knife and give some temperaments, especially among the boys, a satisfaction they do not get from clay. For others, the task of cutting the block away at all is such a labour that it becomes a burden. So while all children should have the chance to try carving, all should not be forced to go on with it.

Materials for Carving

Wood—any solid-shaped pieces which can be obtained, from soft *balsa* wood to split logs, and carpenters' waste.

Plaster of Paris. This need not be the medical type, but may be obtained in quantity from a drysalter. For this a number of small cardboard boxes are the best shapes, or, failing that, one large box.

Various cements. These also need boxes.

Lumps of chalk.

Old bricks or pieces of them, the soft type are best.

TOOLS

Penknives, sandpaper, and if there are any old chisels about, these can be used. No other equipment is necessary, except for plaster and cement, where a basin and metal spoon for mixing are required.

Wood Carving

Children will carve wood as naturally as they paint, and the possession of a penknife opens out a new field of possibilities for the child.

Where the school provides woodwork tools, as all Primary Schools should, the children can help to cut the wood into manageable sizes. The inventive teacher will always begin by using what is to hand; she is not held up for material because it cannot be ordered from a catalogue, or is too expensive for the school to buy. If she can find a few odd pieces of a size that a boy can hold in the hand when cutting, and of a solid three-dimensional (not flat) shape, these can be given out to the boys and girls who have penknives or to those who show most interest, or to any to whom some extra privilege has been promised. With only a minimum of help, they can go ahead carving whatever shape it seems reasonable to bring out of that piece of wood—a boat, an animal, a totem figure perhaps. When the rest of the class see what is emerging they will find wood for themselves, either the scraps which can be picked up in a big city, or the sort of pieces one picks up on a country walk.

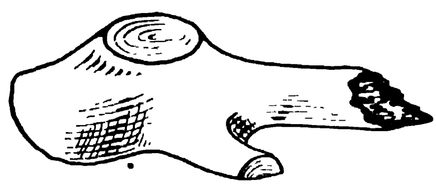


Fig. 32.—A NATURAL PIECE OF WOOD LIKE THIS SUGGESTS THAT A FISH MIGHT BE CARVED FROM IT.

The first thing to suggest to them is that they look at the piece, turn it round, stroke it, notice any knots or knobs, and think of what the shape suggests. They will very quickly find that they cannot cut through a knot and learn to use one to emphasize shape rather than ignore it. One can suggest, too, that they cut away the bigger unwanted parts first and arrive at a rough approximation to the final shape in bold planes, before doing any part in detail. Especially in the first carvings, they should be encouraged to cut away comparatively little, and to choose a subject which is closely related to the shape they start with. Very interesting things can be made with a small amount of cutting. The field of carving pieces found on sea-shores and in woods has been rather neglected, and opens great possibilities (Fig. 32). Sometimes it is possible to buy a sack of odd scraps from the local carpenter. In a town the children can often do the preliminary exploration as to where scrap wood may be had, or a parent may prove to be a carpenter or to know one who will help. In this case a visit to the carpenter's shop is a good idea. He is usually only too glad to give you a bag of shavings which make a welcome addition to the scrap box.

The children will probably want to colour their carvings, and powder or poster colour will do well. Interesting and pleasing colours should be en-

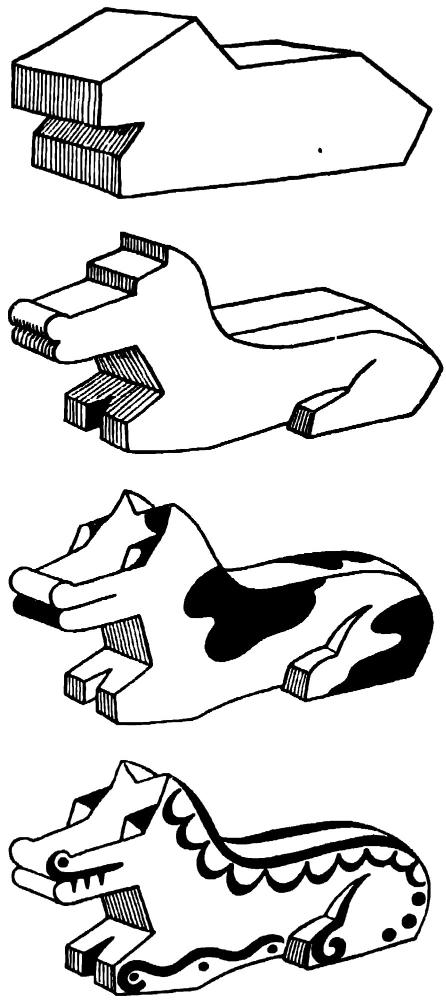


Fig. 33.—Carving a Wood Animal. If a Saw is available, it can be used to start the Job; then a Penknife or an old Kitchen Blade will trim down the rest. It can be painted naturalistically or decoratively as the Child wishes.

couraged rather than naturalistic ones. Fig. 33 shows the carving of a wooden animal and its colouring. Afterwards it can be given a coat of wax floor polish if that appeals. This will protect the surface and keep the paint from smearing if it gets wet. Usually the plain wood waxed and polished, if it is a precious carving to be kept, is more acceptable to adult eyes.

Plaster-of-Paris Carving

Plaster-of-Paris cement and brick form an interesting introduction to the stone carving which is becoming more common in schools. Plaster of Paris is a powder, usually white, which when mixed with water sets quite hard and presents a chalk-like block for carving. It becomes almost hard within about five minutes of mixing, and for some time after that it is still possible to cut it with some ease, but after twenty-four hours it is so hard that the children can only scrape or chip it. The addition of a teaspoonful to a tablespoonful of size to the water will prevent it from setting so quickly.

One can let children begin to carve on plaster of Paris which has not quite set. On the day before, they must be warned to bring any instrument for cutting—a penknife, an old kitchen knife-blade, a piece of metal which does not bend easily—but not anything valuable, as this usage blunts a sharp edge. They are also told to bring a little cardboard box, preferably a deep one, and a shoe-box or deep lid is kept in reserve for those who cannot find a box themselves. Suppose the lesson is the first in the morning after assembly. Then all must arrive in time to mix the plaster before assembly, and spread newspapers round the desk or the sink where it is to be done.

Quantities

Seven pounds of plaster (it is usually done up in 7-lb. bags) and three pints water approximately will fill enough small boxes to make blocks for a dozen children. Plaster of Paris costs very

little, and it is, of course, cheaper to buy it in large quantities. The proprietary cements and Alabastine, which has a pleasant colour and other advantages, cost much more. So plaster is much the cheapest, and it can be coloured to a pleasant shade by the addition of chrome yellow, or a little red distemper, or even powder colour paint.

Method

Cold water is put in the basin and the plaster is sprinkled on to the surface a handful at a time, while the whole is stirred with a metal spoon. When the plaster tends to lie on the surface rather than sink in straightway, the water has taken up all that it will take. Then stir vigorously to get rid of any lumps and pour the plaster into the cardboard boxes up to the top, or part of the way up if they are tall. If any have weak walls which look like giving way outwards, they can be tied round first with a piece of string. The basin can be easily cleaned if it is filled immediately with cold water and left to stand. The plaster falls away from the sides itself. After about ten minutes the plaster in the boxes will have softened the walls of the boxes so that they can be pulled away (Fig. 34). When the children claim their own blocks and begin to cut, papers must be spread over desks or tables to catch the bits. It is best to discourage too much moving about the room, if many are doing carving. This prevents bits getting on the floor and being trampled about. At the end of the lesson, before children begin to move about too much, the bits between the desks should be swept up with a dustpan and brush. Of course, carving can be run as a summer activity out of

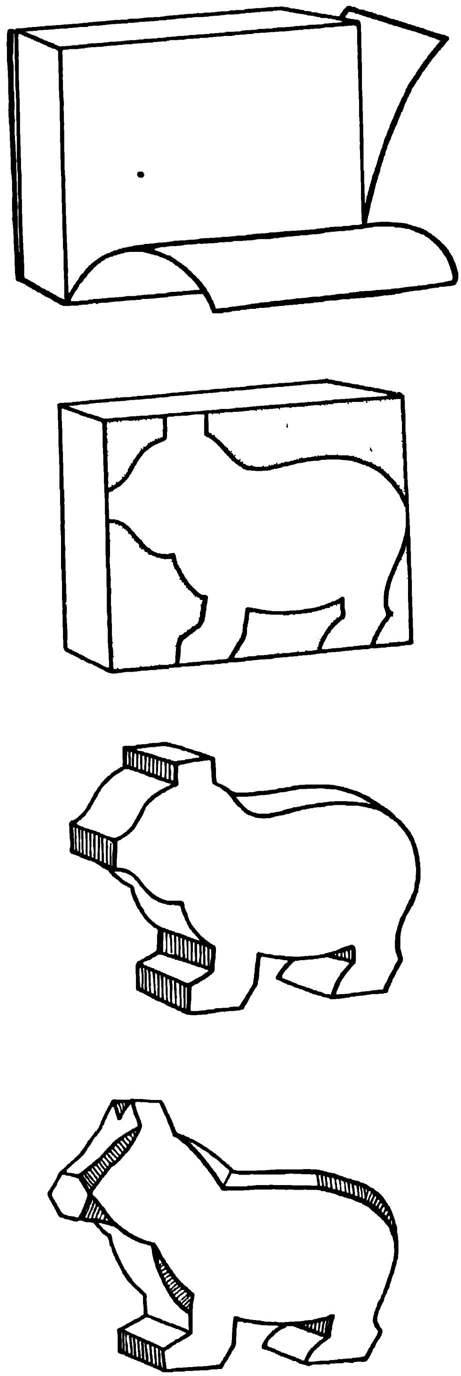


Fig 34.—Stages in cutting a Pig from the Plaster Block.

doors; then there is no anxiety about mess.

For those who have failed to produce a box, or brought one too flat to be suitable, a bigger box up to a depth of from three to six inches is filled. The large block of plaster thus obtained is cut downwards, before it is hard, into pieces of different sizes and shapes—some rectangular, some square—just as toffee is cut. As soon as the cardboard walls can be removed, the *outside* squares are gently separated and given out, then the inner pieces can be easily reached.

If the plaster is poured into the boxes while it is still too soft, it tends to run out at the corners. If this happens, it should be left for a few moments in the basin and stirred constantly. If it comes out lumpy, either it has not been stirred continuously as it was mixed, or too much plaster has been added and the water cannot take up the last spoonfuls. If carving is begun within about five to ten minutes of pouring, then it will be easier to cut away the large portions, but on the other hand the block breaks more easily and pieces that are too large come away. This happens with all beginners, and the children have to be comforted and helped to find another shape which fits the remaining piece. Thus, the dog which was to have been a Great Dane may lose his legs and alert ears and turn into a Dachshund.

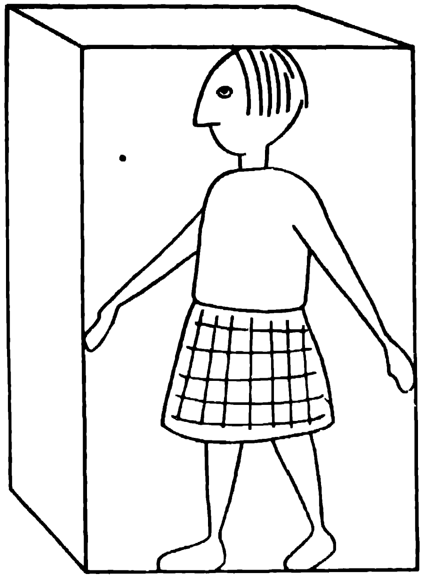
When the blocks are almost hard enough to begin work, the children can pick them up and handle them and turn them this way and that, choosing a suitable subject. Thus, the tall block placed with the broad sides front and back will make a standing figure; while the square block placed broadside downwards might do for a tortoise. After such suggestions, the wise teacher will leave the children to tackle the job themselves without demonstration or further advice. Some children have a natural sense for three dimensions and will know what to cut away in order to get the shape they want. Those can be left to get on till they ask for help. But others will be completely at a loss where and how to begin. These can be quietly gathered in a little group and helped over the initial difficulties in a way that is clearly a second best—only to be resorted to when they just cannot begin at all. This way is to approach carving from the angle that is already familiar to them—that of drawing in two dimensions. Taking the largest flat surface of the block, they draw on it the animal or figure they wish to carve. Remind them to keep it as big as the block and make it touch all the sides (Fig. 34). Then they pencil or paint in the background, leaving the subject light. This is necessary, as is shown in Fig. 35; the first attempt of a a child of eight. She has made her drawing touch the four sides of the block face, but colouring the background shows clearly that the neck, wrists, and ankles are too thin. Parts like the head, etc., will break off if they are not securely joined to the main body. If the figure, as in this case, proves too thin in parts, the block is turned over and a more solid one drawn on the other side. Then all that is coloured is cut away in right-angled downward strokes (Fig. 34). After this, the figure is turned sideways and suggestions made for rounding the head, cutting off some of the sharp corners, making some parts thinner, and so on, thus gradually arriving at a three-

dimensional shape. This may just give the initial confidence to tackle the subject direct next time, but if the child continues to hold to his two-dimensional vision it would seem better to let him work on paper. It will be obvious to the discerning observer that this method would be disastrous for the child with a truly three-dimensional vision and touch. Because of this, it is not possible to give class teaching in this type of subject. Three-dimensional conception is not necessarily a stage following and advancing from two-dimensional, as has sometimes been suggested. Some children have it from an early stage and model truly "in the round" from the age when they can press handfuls of clay. Others never develop it, but continue to create with increasing subtlety in two. There have been great civilizations, such as the Persian and the Moorish, which at their peak periods were concerned chiefly with two-dimensional effects and surface decoration.

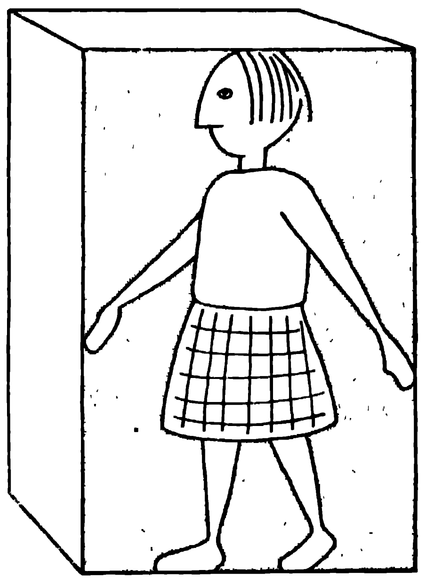
Some teachers prefer to use the plaster quite hard and prepare it the day before. In this case it facilitates cutting if the plaster is damped before use.

Commercial plaster of Paris is either white or slightly coloured. If it is white, the children may want to paint their models if the plaster has not been tinted by one of the drysalter colours suggested. The pig in Plate IV is coloured pale pink and has black markings, added in paint.

Subjects can be as varied as imagination suggests. Human and animal are the most popular, from the fairly naturalistic to the quite fantastic. Human beings are found to need a solid base, either in a "Mrs. Noah" shape



HERE THE CHILD HAS OBEYED THE INJUNCTIONS TO MAKE HER DRAWING TOUCH THE FOUR SIDES OF THE BLOCK FACE.



BUT WHEN THE BACKGROUND IS COLOURED IN, THE FIGURE IS SEEN TO BE QUITE UNSUITABLE FOR CUTTING, AS THE WRISTS, NECK, AND ANKLES ARE TOO THIN.

Fig. 35.

in which the figure itself is made solid, or by being placed on a solid base (Fig. 36). It is important to suggest to the children that they set down their carving from time to time to see how it stands, otherwise it may be all worked in the hand and have no balance.

Chalk Carving

Some schools have found in the neighbourhood lumps of natural chalk so large that they invite carving. Since these are found in strange irregular shapes, the essential thing is again to hold the lump, weigh it, handle it, and look at it until some subject is suggested by it. Some children will tend to surface carve on one face only and have to be persuaded to turn the lump round as they work. When the general idea of the shape has been cut, then one can just suggest that in some parts the surface may be left plain, and in contrast, other parts—perhaps the hair or the face—will have a good deal of detail. But to work on the surface of all parts equally will tend to make it look fussy, just as it would in a painting. The box-shaped pieces of plaster of Paris tend, at first, at any rate, to result in box-shaped dogs and cows. One can vary this by using circular oatcake or cheese boxes, or cutting a larger block into different shapes—before it hardens, of course. These irregular-shaped pieces of chalk compel the child to search for the appropriate subject and so to look at shapes more thoughtfully. So this is more appropriate for ten-year-olds than those younger (Plate IV, lower picture).

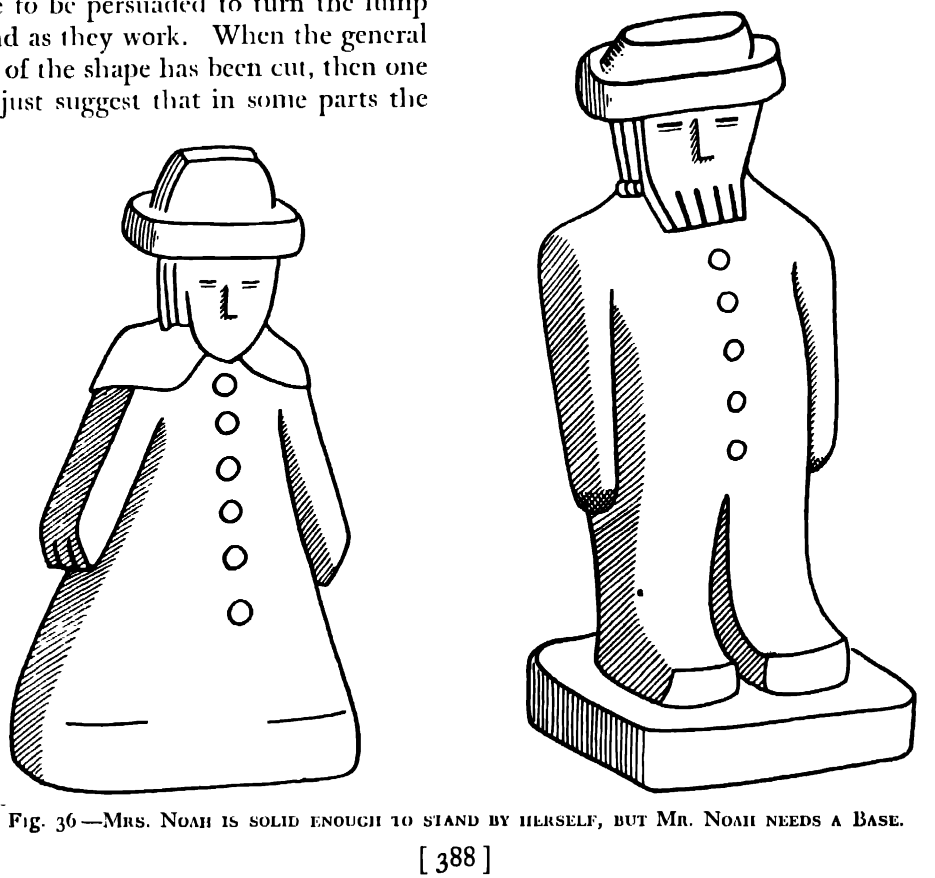


Fig. 36—Mrs. Noah is solid enough to stand by herself, but Mr. Noah needs a Base.

Brick Carving

During wartime the extreme shortage of craft materials forced enterprising teachers to find handcraft materials in all sorts of unexpected places. One such material is ordinary building brick, or, better still, the softer kind used for insulating furnaces. These can be obtained as "throw-outs" from the brick-yard, or may be picked up when a furnace is being relined or a building pulled down. The important thing is always to be alive to what is going on in the neighbourhood, so that much useful material can be found with little or no expenditure. This experiment has had most interesting results. Here, again, we begin with a solid shape which must dominate the choice of subject and the form in which it is to be portrayed. The material is very hard and resistant, yet the children have managed to achieve a surprising variety within the confining shape of the brick.

Tools and Method

The tools are just any which will break or scrape bits off the bricks—penknives, old chisels, hammers, bits of carborundum stone. After considering the shape and deciding on a subject, the children damp—not wet—the bricks and start hacking out the main forms. They are led to look for the large forms and omit details. The spongy, porous quality of the brick and its coarse texture give a stone-like quality to the finished piece, and here painting does not seem so appropriate.

Conclusions on Carving

It is doubtful whether taking the children to see carvings before starting them on such work is of value. If they have been making an environmental study, and the idea of carving has been spontaneously suggested by the work in a village church or market cross or fountain, that is a different matter. But to bring to their attention very competent and especially intricate work when they are just beginning their often fumbling efforts is more likely to discourage them and spoil the simple shapes they themselves conceive, than it is to help them. If they do get the *idea* of carving from a church, they will not pause to study detail at this age, but be swept on to carving on the strength of the idea alone. That is usually enough.

Intelligent children who have done some carving will look with added interest at the pictures of carving of long ago on their History Charts, Volume II—the fine animals carved by the Assyrians, the lovely wayside crosses of the Celts of Ireland and Saxons of northern Britain; the carvings on Norman churches, etc. Every new form of handwork learnt gives, or should give, children a new vocabulary, new interests, and opens their eyes to many things they have passed by without caring to look.

Working with such a very hard and resistant material forces the carver to a definition of the form, and since so little can be represented, he has to ponder on what are the essentials. Again, because the material is so resistant to every cut that is made, its nature cannot be ignored. It must be understood and worked *with*, not *against*, and when a child realizes this, he has come to the beginning of craftsmanship.

FREE ACTIVITIES

CHAPTER ONE

ACTIVITIES IN SCHOOL

THE process of education can be considered perhaps as the fusion of the individual with his environment. There are therefore two elements which have to be brought into harmony with one another, and the process of bringing them into harmony is the process of education. Free activity is one way of achieving this, since it means bringing children into direct contact with their environment and giving them opportunities to experiment with various forms of self-expression.

The term " Free Activity " fills many people with anxiety. To some, freedom is the antithesis of discipline and activity inconsistent with learning; to others, the words conjure up visions of unruly children, intolerable noise, and failure to "cover the syllabus"; to many parents the expression means waste of precious time which should be given to "preparation for the scholarship." Even where free activity finds a place on the time-table, it too often merely becomes just another " subject " of the curriculum.

In practice, however, it has been found that to allow children to pursue their own lines of study and to acquire knowledge through experimenting with different materials raises many fewer discipline problems, produces much greater understanding of the material and human world around them, and results in a much sounder and wider store of knowledge.

It is essentially a method through which the children take the most active part. This means, therefore, that the children search for information from a book or from the countryside; that the children experiment with sound, that the children create some original object in clay or other media, that the children express their own thoughts in words or in colour. Physical movement is only one of many forms of activity; any occupation through which children are teaching themselves and expressing their ideas comes under the term " activity " as used in these pages.

The extent to which freedom of choice can be allowed is governed by two factors—the materials and equipment available and the *freedom of the other members of the class.* The former restriction can be overcome in time, but the latter is always operative. Indeed, one of the great values of free activities is the natural discipline that it necessarily imposes on every member of the class. It is hardly too much to say that respect for the freedom and rights of the other members of the community is the only rule that is absolutely essential in the school. If this is recognized by

all, then every child will be able to enjoy freedom to pursue his individual interests within the framework of the community setting. In schools where this approach to education is in operation, the children show far more independence of thought and action, far more initiative and adventurousness, a greater degree of self-discipline, and an enjoyment of school life which comes from a fully occupied mind and an active body.

Your class of seven-year-old children, for instance, in a big Junior School always spend some time every morning pursuing their own particular interests. These children have been brought up through the Infant School to settle down to their own occupations and to select what they wish to do themselves. During the previous few weeks they had become interested in their diaries (and through that in reading), and on this particular occasion some of the children had decided to add something to their records. Others took out reading-books and sat quietly at their desks reading; a group of three children wanted to share a picture-book, so they squeezed themselves into one desk and propped up the book so that all could see. One little girl was fascinated by a big jigsaw spread out on a blackboard laid over two desks. One group of children put on aprons, rolled up their sleeves, and went off to a corner of the room to make things in clay. One or two children preferred to do something by themselves. For example, one boy worked with Plasticine, making various models, while another made an object out of cardboard.

These children had chosen their own occupations—not one child was wasting time. They were all absorbed in what they were doing. If a child moved about the room, it was with some set purpose. There was no question of lack of discipline. Discipline was self-imposed, simply because each child was eager to get on with his own job. Each child was satisfying a particular need in the manner and through the medium that he felt desirable.

In another classroom another group of seven-year-olds were engaged in "Home" play. Two little girls were playing with a doll. The doll was being dressed to go out, and the bed was being made in readiness for the time when the doll had to go back to bed. Two other little girls were sewing. They were making covers for the doll's bed and furnishings for the home. The girls took the initiative in this activity and took over the complete control of the classroom. They determined, for instance, that the boys' place was in the "office." The boys, therefore, were not allowed to sew or look after the doll. They had to go to desks labelled "Office" and do office work—which on this occasion consisted of sums. Not all the girls took part in the more active occupations. Two joined the boys at the office and did some writing and sums, and others wrote at "home." But whatever the actual job done by each individual, the central idea of all their activities was the home. At first only one or two children took up needlework (they were too young to have any systematic teaching of the subject), but gradually the interest in needlework spread, and after a week or two all the girls and some of the boys had used a needle to make some object for the home. This was particularly interesting because the teacher had begun some very simple needlework with the children at the beginning of the year,

but had put it on one side when she found that they were not really interested. By the end of the year, however, every piece of needlework that had been discarded earlier was finished and had its place in the children's "home."

In another school, there happened to be a spare room. This was turned into an attractive reading and quiet room. Most of the floor was free of furniture, but mats were scattered here and there. Desks and tables were arranged round the room, and on some of the tables reference books on different subjects were placed.

From time to time children went into this room in an informal way to do a quiet job of work. The floor was a favourite place for reading, the children sitting about on the mats with their library books. On the whole it was the boys who favoured this position for reading rather than the girls. Some children went to the tables and became absorbed in the encyclopædias and nature books. Others sat at the desks, either reading or writing, and others again brought needlework or handwork to do. This was a quiet room where anyone could go and do a job away from the noise and bustle of the classroom.

A group of ten-year-old girls in a rather poor district were encouraged by their teacher to take a really keen interest in household jobs. Most of the girls had some responsibility at home, and the teacher thought that by learning how to do the work properly the children would become interested and realize that any home task was really worth while.

The interest in household work was greatly increased by a Safety First Exhibition held in the school. One of the sections dealt with "Safety in the Home," and these girls took charge of this bay and gave instruction to visitors on how to procure safety in the home.

When the children were engaged in their household duties, they divided into groups, one group going to the Staff Room, another to the Head Teacher's Room, the rest remaining in their own classroom. Usually the children were occupied with different jobs. For example, on one occasion six children did shoe cleaning, another six cleaned brasses, and the others had a tea-party. For occupations like these it is necessary to prepare beforehand and to enlist the co-operation of the parents. The shoe-cleaning group, for instance, had brought to school their fathers' shoes, and only the largest size of shoe was any use to these children, who loved to see the big surface take on a good shine.

The same tendency to find large objects was evident also with the Brasso group. The bigger the vase, the better, and the vast amount of Brasso used was out of all proportion to the need. However, in time the children learnt that a small quantity was far more effective than a larger amount.

The children having a tea-party had a lovely time. Tables were properly set. China and cutlery were put out, and real tea was brewed. One child sat at the head of each table (there were three tables altogether) and poured out —the rest of the children learnt to behave in an orderly manner and to use the cutlery correctly.

Starting with a conventional lesson in Geography, the children in another school became interested in the materials which were used to build the school and the houses around—bricks, tiles or

slates, mortar, etc. This became an absorbing activity and led to a fine collection of pictures of houses, with notes on how each was built. Although not so much a free as guided activity, it was within the children's comprehension and interest.

In a mixed class of eight- and nine-year-old children, it was the custom to have certain selected occupations available for one or two afternoons during the week. During one term a desire for making bamboo pipes had developed, and one of the occupations was connected with this; another occupation was making puppets; a third was painting, and a fourth reading and writing. The children could choose their occupations, and as a rule it was the boys who chose to work at the pipes, the girls who chose to work at puppets, and both boys and girls chose painting or writing.

The children got together in groups according to their occupations and arranged themselves quite informally in different parts of the classroom. One group of boys had finished making their pipes and had progressed some way towards playing. These five children formed one group and played various tunes without music. Five other boys were at different stages in pipe-making and were working individually. Another boy was practising a tune from music by himself. Two other boys were reading, another was getting help from the teacher in making the head of a puppet. Four girls were well forward with dressing puppets, and other girls were either painting or reading or writing, or doing some form of needlework or handwork not connected with puppets. In this informal setting, there was some necessary chatter and movement, but nothing approaching disorder. The children behaved naturally and sensibly, and with the degree of self-control that can reasonably be expected from children of this age. At quite an early age, children can be helped to realize that thoughtful, worthwhile work cannot be done in a noise.

In all these examples, the children were experimenting with different kinds of material; they were learning to select, they were learning to act independently and to express their own ideas and thoughts in the medium that seemed most suited to the particular work in hand. The choice they made and the success or failure of their efforts give some indication of the type of work that we should try to provide in school. But children's out-of-school activities also have an important bearing on this question, and the next chapter gives some indication of their scope.

CHAPTER TWO

ACTIVITIES OUT OF SCHOOL

THE out-of-school activities of children are very varied in detail, though they can be grouped fairly conveniently into eight different categories.

Among 976 boys and girls between the ages of seven and eleven, a total of 167 different occupations have been recorded, of which (1) two can be classed as forms of what might be called *passive entertainment*, (2) twenty-five as *intellectual occupations*, (3) twenty-five as *social*, (4) forty-four as *practical*, (5) twenty-six as mainly *physical*, (6) twelve as *imaginative*, (7) twelve as *relating to living things*, and (8) twenty-one as *artistic in character*. It is usual, of course, for children to have more than one favourite occupation. These may all fall into one category, but it is more likely that they will fall into two or three, and in this way children show certain occupation "patterns" (see Tables I and II, pp. 9 and 10). For example, if the eight categories just mentioned are numbered 1 to 8, a child's occupation pattern might be 1, 2, or 4, 5, 6, or 1, 2, 6, 8, and so on. The extreme variety of interests is shown by the fact that there were altogether 155 different patterns amongst the 976 children. The most usual pattern was a combination of physical and intellectual pursuits, but even this was common to not more than 10 per cent. of the children. Among the less common patterns, 200 children showed 100 different patterns, and an average over the whole group works out at just over six children per pattern. This means that in a class of 48 children it would be reasonable to expect eight different patterns of out-of-school occupations, and it would be quite possible to find 48.

Although individual differences are great, certain patterns tend to appear more frequently than others, either combined with other types or alone. Such combinations as physical and intellectual pursuits, or intellectual and practical pursuits, occur more frequently than the practical-physical combination, and intellectual interests combine with social interests relatively infrequently. These facts show that although there are great individual differences, there is a broad framework common to Junior children as a whole.

Category 1: Passive Entertainment

Only two forms of entertainment could be put into this category—the Radio and the Cinema. It is an interesting fact that although children do go to the cinema fairly frequently and regularly, it does not rank high as one of their favourite occupations. Nor does listening to the radio. Children of Junior School age appear to prefer to take a more active part in their leisure pursuits than is possible through the cinema or the radio.

CATEGORY 2: INTELLECTUAL OCCUPATIONS

Into this category are grouped all those occupations which are related to school work, such as reading, writing, and correspondence with older children. Collecting also has been put here.

The urge to collect is strong at all stages of growth, but it is strikingly apparent between the ages of seven and eleven, when it appears to represent a stage in intellectual development. Junior School children collect all sorts of things—badges, stamps, newspaper cuttings, autographs, pictures—a vast assortment of objects find their way into the collecting-boxes, books, bags, and pockets of children at this stage. Age seems to have but little influence, and all through the Junior period this collecting and classifying occupies much time and endless swapping. Collections suggested and enjoyed by children are given in NATURE STUDY (this Volume); ENGLISH (Vol. II), etc.

Although children collect a great variety of objects which may vary from time to time as well as from child to child, these choices must have significance, so the actual process of collecting and classifying is a form of intellectual activity, and for this reason it is put into this category.

Reading is another favourite pursuit of Junior children. Just as collecting different objects must indicate differences of interest, so choice of reading material must have some significance; but one thing is common to all reading, namely, the widening of vocabulary and the stimulation of thought, and it is for this reason that reading is included in this group of intellectual occupations. Reading related to geography, history, and school work in general fall into this group, as well as writing tales and correspondence with other children at home or abroad.

This whole class of occupations takes a high place in children's out-of-school activities, and is worth encouraging.

CATEGORY 3: SOCIAL ACTIVITIES

Into this class can be put all those occupations which necessarily involve groups of people. These activities mainly take the form of joining a club of some kind. Church clubs are prominent, and Guides, Brownies, Cubs, Scouts, and similar organizations attract children of this age. The younger children seem to enjoy this form of social activity more than the older ones, and during the Junior period it reaches its height with girls of eight years of age and with boys of seven.

CATEGORY 4: PRACTICAL ACTIVITIES

These include a great variety of occupations which are chiefly concerned with making things. It is this group that consists of the greatest number of different activities, and it is a group which is characteristic of a large number of children, almost equivalent to the number interested in intellectual occupations.

The recorded occupations fall into four types. One type consists of activities with raw materials. They are activities in which the raw materials are converted into some object. Clay, wood, and cardboard are the raw materials most frequently used, but there are many other materials that can be provided. A second type consists of using " parts "—for example, the parts of a Meccano set, building bricks, jigsaw pieces, etc. Mechanical models, motors, cranes, guns, and aeroplanes, are examples of the kind of objects often made from these "parts," especi-

ally by the boys. It will be noted that they are objects which should "work." Some such models did actually "work," like the aeroplanes which were greatly in evidence a little time ago.

The constructive activities of girls take a rather different form. Instead of making things that should "work," they tend to make more static objects. Jigsaws, for example, or buildings made with bricks, rug-making, making designs in weaving or embroidery or with mosaic tiles, beads, or sticks. Of course girls do from time to time join in occupations involving the construction of working models, but such activities are relatively rare. Boys, too, make buildings from bricks and put together jigsaw puzzles, but on the whole girls tend to turn to design, while boys find expression in some object that "works."

The third group of activities is rather different in character. They are not concerned with the construction of an object; they are concerned with such occupations as gardening and chemistry, in which the activity only indirectly produces the desired result. The children's action merely sets in motion other forces which alter the original substance. Some activities in this group consist of the transference of force, as, for instance, in billiards or playing with model yachts.

The fourth type of activity is concerned with the performance of some action related to people rather than to things. Such actions as doing jobs in the house, going errands, and playing at games like "shopping" come into this group.

Category 5: Physical Occupations

The division between the practical and physical occupations is difficult to define. Into the latter, however, have been put all those activities which are primarily concerned with large physical movement as distinct from the activities in which finer movement is required—for example, the use of tools. Outdoor games, cycling, football, folk-dancing, skipping are examples of the type of occupation included in this category. It is only to be expected that these occupations should take a high place among the eight categories. Actually, although this group does hold the highest place, just under 50 per cent. of the children recorded some form of physical activity. Physical activities are brought so readily to notice that there is a danger of assuming that all children of Junior School age enjoy this type of occupation. That this is not the case should be remembered in providing opportunities for free activities in school.

Category 6: Imaginative Occupations

These are more characteristic of girls than of boys, and seem to provide intellectual stimulus for girls, just as collecting and classifying do for boys. These occupations might even have been put into the Intellectual category.

Two forms of imaginative activities are evident. In one form the children enact scenes, imitate people, and impersonate people. Such games as playing at "House" or "School," dressing-up and playing with dolls are typical. In the other form books play an important part, reading fairy stories, historical tales, and looking at picture-books being characteristic occupations of an imaginative character. Among seven-year-old girls imaginative activities rank high, taking fourth place after practical, intellectual, and artistic occupations; but over the Junior period as a whole

they take only the seventh place, due to the falling off in such pursuits amongst the older children.

Category 7: Occupations Relating to Living Things

Surprisingly few children seemed interested in living things. This may be due partly to the children's home districts, which were mainly urban or suburban areas. But in spite of this, the variety of interest was remarkable in view of the relatively small number of children concerned.

Keeping dogs and cats was typical; some children also had a more general interest in nature, as shown by enjoyment in visits to parks or rambles in the country or in reading books on natural history.

Category 8: Artistic Occupations

Four forms of artistic expression are included in this group—colour, rhythm, sound, and form. The colour work was chiefly in the form of painting; rhythm work in design and pattern-making; sound in any form of music-making; and form consisted mainly in drawing. Both boys and girls enjoyed one or other form of artistic occupation, and interest in different forms varied very much at different ages and with different sexes.

Interest in colour appears to be more common on the whole than interest in the three other forms of artistic expression, although this may not be true at all ages or for both boys and girls. Among boys, for example, only at the eight-year-old stage do colour activities take first place; this is the age when as a whole there is the greatest interest in not only colour but all forms of artistic expression. Among girls the maximum interest is shown at the ten-year-old stage, but during the Primary School period colour activities take precedence over all other types of artistic occupations.

Form takes second place. It is interesting to find that boys enjoy drawing more than girls, and that among the boys this form of artistic occupation ranks higher than any other except at the eight-year-old level. Both painting and drawing become less common among the ten-year-old boys. Drawing as such is not a favourite occupation of girls at the top end of the Junior period, while painting and occupations that involve colour take top place at every age.

Occupations related to sound are more characteristic of girls than of boys. Singing and playing instruments of various kinds, chiefly the piano, are the most common forms of occupation.

The fourth type of activity in this whole category—rhythm—does not seem to rank as high as colour, form, or sound. This may be due to the fact that many forms of rhythmic activity are associated with groups. This is certainly true of percussion work and most forms of movement. There are forms of rhythm that are individual and which have been recorded by children as favourite occupations. Work in design, recitation, and singing can be considered as coming into this category. Interest in this form of occupation shows a falling off at the eight and nine age levels. It is most in evidence at the bottom of the school, but shows signs of increasing again among ten-year-old children.

CHAPTER THREE

THE BROAD CHARACTERISTICS OF JUNIOR SCHOOL CHILDREN

TABLES I to VI show the general distribution of out-of-school activities among boys and girls of different ages.

Tables I and II give a few examples of the occupation patterns of children of different ages. It is evident that individual differences are great, but in spite

TABLE I.—OCCUPATION PATTERNS : BOYS

Children		*Occupation categories*								
Age group	*Case*	1	2	3	4	5	6	7	8	*Occupation pattern*
7 +	A					//				5_2
	B					//				5_2
	C		/		////					2, 4_4
	D			/		//				3, 5_5
	E			//						3_2
8 +	A		/		//				/	2, 4_2, 8
	B		/						//	2, 8_2
	C					/				5
	D			/		////				3, 5_4
	E				/					4
9 +	A				/	/				4, 5
	B					/				5
	C		//	/	/	/				2_2, 3, 4, 5
	D	/								1
	E	/		/					///	1, 3, 8_3
10 +	A	/	/ •	/			/		/	1, 2, 3, 6, 8
	B				/	/			/	4, 5, 8
	C				/	//				4, 5_2
	D				/	//				4, 5_2
	E		/							2
		3	7	7	12	19	1	0	8	

of this the general framework begins to emerge. The importance of intellectual, practical, and physical occupations stands out even from these forty examples which were taken at random from all the records. The relative insignificance of the imaginative activities and occupations relating to living things also begins to appear.

Tables III and IV give the percentage of boys and girls of different ages choosing the different categories of occupations for the whole 976 children. Table III shows, as we should expect from even casual observation of children, that among boys physical activities rank high—63 per cent. occupying themselves with some form of physical pursuit. These are followed by intellectual, practical, and artistic activities in that order, with passive forms of entertainment taking the bottom place. The sevens and tens show the same order of preference for the different

TABLE II.—OCCUPATION PATTERNS: GIRLS

Children		*Occupation categories*								
Age group	*Case*	1	2	3	4	5	6	7	8	*Occupation pattern*
7 +	A		/				/			2, 6
	B				//					4_2
	C						/		//	6, 8_2
	D				/	/			/	4, 5, 8
	E	/	/		/					1, 2, 4
8 +	A	//	///	/	//					1_2, 2_3, 3, 4_2
	B	//		/	///					1_2, 3, 4_3
	C				/	/			/	4, 5, 8
	D			/						3
	E						/			6
9 +	A				/		/			4, 6
	B	/	//			/				1, 2_2, 5
	C		/		//					2, 4_2
	D				/				/	4, 8
	E				//					4_2
10 +	A		/		//					2, 4_2
	B		/			/				2, 5
	C		/			////			/	2, 5_4, 8
	D		/		/			/		2, 4, 7
	E					//				5_2
		6	12	3	19	10	4	1	6	

categories, but at the ten-year-old level interest in physical and intellectual pursuits becomes more universal, while among the sevens the activities are more evenly distributed. The eight-year-old-age group shows the greatest divergence from the normal order, with practical pursuits becoming more important than intellectual, and interest in living things becomes almost negligible.

Physical activities take first place at each age and increase in importance as the boys grow older. Intellectual occupations are at their maximum importance during the ten-year-old age and at their least importance at eight-plus.

This distribution throughout the four Junior School years, namely, a drop at eight-plus compared with seven-plus and then a steady rise to ten-plus, is also characteristic of the passive entertainment group of pursuits. The distributions of imaginative and artistic activities can also be compared and show the reverse trend to that of the intellectual occupations, that is, a rise from seven to eight and then a steady fall to the end of the Junior School period. Social pursuits and occupations

TABLE III.—PERCENTAGE OF CHILDREN CHOOSING DIFFERENT CATEGORIES OF OCCUPATIONS

BOYS

Category	*Age groups* 7 +	8 +	9 +	10 +	*All ages*
1	11	10	15	16	13
2	45	40	46	58	47
3	27	15	18	16	21
4	31	49	30	36	35
5	49	65	72	75	63
6	4	13	9	8	8
7	10	1	11	10	9
8	30	39	32	20	30

TABLE IV.—PERCENTAGE OF CHILDREN CHOOSING DIFFERENT CATEGORIES OF OCCUPATIONS

GIRLS

Category	*Age groups* 7 +	8 +	9 +	10 +	*All ages*
1	8	17	16	16	14
2	37	43	37	49	41
3	13	32	20	22	21
4	51	53	47	60	50
5	29	29	47	48	37
6	31	18	8	5	17
7	7	3	3	5	5
8	37	28	23	34	31

connected with living things form another pair of occupations which follow similar changes throughout the four years. In both these there is a drop from seven-plus to eight-plus, then a rise to nine-plus followed by another drop to ten-plus. Practical activities stand alone, showing the reverse distribution to that of social pursuits. This category is of greatest importance at the eight-year-old age.

An examination of the distribution of each category through the four years shows that in five instances out of the eight a change in trend occurs between seven and eight years of age (categories 1, 2, 3, 6, and 8). In two of the remaining categories, that is, practical occupations and activities associated with living things, the change occurs during the eight-year-old stage, and with physical activities the trend is constant throughout the four years.

While there is a certain similarity between the activities of boys and girls, there are noteworthy differences in detail. The similarity lies in the fact that intellectual, practical, physical, and artistic occupations are more favoured

than the other categories. The difference arises in the order of preference, practical pursuits taking the first place, with physical activities only third. Imaginative pursuits are more characteristic than any form of passive entertainment, and occupations connected with living things hold the lowest place. Practical activities take the highest place at every age, tying with physical at the nine-year-old level but reaching maximum importance among ten-year-old girls.

Girls' activities as a whole are more dispersed than boys. There is less concentration on one or two types, and every type has its attraction for some children. Definite trends, as age increases, are not as evident. In only three categories is there any noticeable trend; physical activities become more common in the nine- and ten-age groups; there is a steady drop in imaginative activities during the four years, and artistic pursuits, after decreasing in importance during the first three years, become more common again at the end of the period.

Tables V and VI give an overall picture of children's out-of-school activities for the whole Junior School period. It will be seen that for children as a whole, 49 per cent. take part in some form of physical activity; intellectual and practical activities come next, attracting respectively 44 per cent. and 43 per cent. of Junior children; then follow artistic occupations (31 per cent.), social activities (21 per cent.), some form of passive entertainment (14 per cent.) and imaginative occupations (13 per cent.); occupations connected with living creatures come at the end of the list—only 7 per cent. of the children taking part in these activities.

The order of preference varies for different age groups. Only the nine-year-old children show an order similar to that of Junior children as a whole, and even in this case the proportion of children selecting the different occupations is considerably modified. Other significant facts emerge from an examination of Tables V and VI. One noticeable feature is the constant position occupied by artistic activities. These come fourth in order of preference at every age, with only a range of 6 per cent. between the different groups of children. The position of social activities is also constant in the fifth place, with a range of 7 per cent. Interesting, too, and perhaps unexpected, is the position of intellectual pursuits. These take second place at all ages.

The interchange of position of physical and practical occupations in the two upper and two lower age groups is noteworthy. It is interesting, too, to observe that the order of preference for the seven- and eight-year-old children is the same, though the proportion of children choosing the different types of activities differs, and the order for the nine- and ten-year-old children is the same in respect of the most important occupations.

Perhaps more significant than the order of preference is the change in percentage of children occupying themselves with different types of activity as age increases. Physical activities, for example, increase by 22 per cent.—from 39 per cent. among the seven-year-old children to 61 per cent. among the ten-year-olds. Imaginative occupations drop 11 per cent.—from 18 per cent. among the sevens to 7 per cent. among the tens. Enjoyment in artistic activities also shows a drop (only 6 per cent. it is

true) from 34 per cent. to 28 per cent., and intellectual activities show a steep increase at the ten-year-old level. An increase from 9 per cent. to 16 per cent. of the children showing interest in some form of passive entertainment is perhaps to be expected, since the activities include the Cinema. It is surprising, however, to find so small a percentage of children recording this as one of their favourite occupations.

These changes suggest a relationship between age and choice of occupation. On the other hand, social and practical activities and occupations related to some form of nature show no clear trend with age, and it seems probable that these are special interests characteristic of particular children rather than associated with a particular age.

The outstanding characteristics of Junior children emerging from this study of their pursuits seem to be three. One is the great desire to *move* about. This is more common among boys than among girls, but it is evident at all ages and among both sexes. Although it is important, it is necessary to remember that not all children have this urge, and there is an appreciable number of children, especially girls, who do not find this form of activity particularly attractive.

The second characteristic is a great desire to *do* things of a practical nature. This seems to be the urge to create and construct, and when it is dissociated from physical movement it is more common among girls than among boys. The third characteristic is the great desire to *know*—the urge of curiosity which leads children to ask questions, to take things to pieces, and to find out how things work.

Less outstanding, but worthy of note is the desire to express a thought or idea through colour, sound, movement, rhythm, or words, and the social urge, which is more in evidence at the beginning of the Junior School period than at the end.

TABLE V.—PERCENTAGE OF CHILDREN CHOOSING DIFFERENT CATEGORIES OF OCCUPATIONS
ALL CHILDREN

Category	*Age groups* 7 +	8 +	9 +	10 +	*All ages*
1	9	14	16	16	14
2	41	42	41	54	44
3	20	26	19	20	21
4	42	52	39	42	43
5	39	42	59	61	49
6	18	16	9	7	13
7	9	2	7	8	7
8	34	32	28	28	31

TABLE VI.—ORDER OF PREFERENCE OF THE EIGHT OCCUPATION CATEGORIES

Children Sex	*Age*	*Order of preference*							
Boys	7 +	5	2	4	8	3	1	7	6
	8 +	5	4	2	8	3	6	1	7
	9 +	5	2	8	4	3	1	7	6
	10 +	5	2	4	8	3	1	7	6
All boys		5	2	4	8	3	1	7	6
Girls	7 +	4	2	8	6	5	3	1	7
	8 +	4	2	3	5	8	6	1	7
	9 +	4	5	2	8	3	1	6	7
	10 +	4	2	5	8	3	1	6	7
All girls		4	2	5	8	3	6	1	7
Boys	7 +	4	2	5	8	3	6	1	7
and	8 +	4	2	5	8	3	6	1	7
Girls	9 +	5	2	4	8	3	1	6	7
	10 +	5	2	4	8	3	1	7	6
All children		5	2	4	8	3	1	6	7

CHAPTER FOUR

THE SCHOOL ENVIRONMENT

THESE Junior children, with the three fundamental characteristics—a love of movement, the need for expression through making and doing, and the desire for knowledge—form one element in the process of education. The other element is the environment to which they have to become adjusted. Direct experience of this environment through free activity is one method of effecting this adjustment.

At the school stage, the environment has to be so designed that the *needs* of the children are met, and so controlled that adjustment to community life is gradual. The environment, therefore, must present different types of experience—physical, creative and constructive, and intellectual, to satisfy the needs of the children, and social experience to satisfy the requirements of life in a community.

Physical experience can take many obvious forms. Physical training, games, and dancing are activities which are rarely omitted from the school time-table. The change in these branches of physical education from the formal drill to the freer agility work reflects clearly a change of approach from imposed activity to self-expression through movement which is characteristic of the trend of Junior School education in general.

There are some forms of physical exercise, however, that are seldom given an opportunity of development in school, but which might be introduced with success. Skating, for instance, with its rhythm and balance, might well find a place among physical activities. Most towns of any size have rinks, and there seems no reason why these, like the swimming-baths, should not be used for school purposes. Children very much enjoy this form of activity, and the gain in skill and physical development would be considerable if skating were included in the school's activities. Ice-skating is more difficult owing to lack of facilities, but where these are available children should be allowed to enjoy and experience the speed, balance, and rhythm of this exhilarating occupation.

Enjoyment in movement for its own sake can be fostered through such activities as throwing, running, jumping, and skipping. The eagerness with which children enter into athletic sports is testimony to their enjoyment in these forms of movement. In this development of physical education, it is interesting to note how the elaborate apparatus and formal technique are giving way to simple, pure movement.

These simple activities have the advantage over field games, because they are individual in character. A child can reach proficiency and skill without being dependent on others; he can find an outlet for his urge for action in these forms of movement without having to coax others to join in; he can find satisfaction in movement even in a

school too small to provide a team of footballers. They are essentially forms of activity which can be available for free activities.

But these activities are directly related to physical education as such. There are other forms of movement which are more incidental but which also provide experience in this mode of expression. For example, rambles in search of flowers, birds, and rocks can become a real joy to children at the top of the Junior School. If interest is fostered at this stage, then rambling and camping will become more than a jolly outdoor pastime. Cycling is another form of activity for older juniors which is well within the scope of many, especially country, schools. These three activities—rambling, camping, and cycling—are incidental to other forms of experience which will be discussed later, and they tend to be lost sight of as means both of satisfying the children's desire for physical movement and at the same time providing a way of widening the children's experience of their environment.

Other forms of activity bring into play the finer muscles and demand manipulative skill and precision. These include model-making, art, music, and constructional work of all kinds. The search for information, whether it means going to a book or visiting a railway station or inquiring at a library, also involves action. Opportunities for this kind of movement are almost unlimited and are within the capacity of almost every school to provide. But alongside this there must be opportunities for relaxation, which is itself a form of physical experience, and opportunities should be provided for quiet, restful moments when needed.

Creative and constructive experiences are grouped together, although there may in fact be a difference between purely constructive and creative activities. Constructive activities may be concerned with making a copy of some known object or building—for example, making a crane with a Meccano set from instructions, or fitting a jigsaw together. These do not involve creative thought. They are constructive occupations, but not creative. On the other hand, constructive work may be creative—as, for instance, in the building of an edifice of original design. This would involve both creation and construction. So would modelling in clay some pleasing shape, or dressing a doll for some specific purpose. Creative work, on the other hand, need not involve construction at all. Writing a poem or making a tune or evolving some movement may be creative, but is not constructive in the manipulative sense in which the word is used here. Hence constructive experience can be gained without creative effort, and creative expression need not involve constructive experience. It is important that there should be opportunities for both creative and constructive experience in school.

For free activity work in school, opportunities should be provided for children to experiment in all the different forms of constructive and creative occupations that characterize their out-of-school play. This will mean the provision of raw materials and "parts," opportunities for simple experimenting in science and mechanics, etc. (See Section One, NATURE STUDY AND SIMPLE SCIENCE.)

As wide a variety of raw materials as possible should be provided: rough wood, fire sticks, paper, cardboard, clay,

cane, reeds, metal, matchboxes, odd pieces of cloth—all these can be used and converted into an object which is needed for some particular purpose, either directly related to some work going on in school or to a hobby, or as the expression of some original idea or thought. Whatever the direction of a child's interest, he should be able to find some type of raw material with which he can satisfy it.

It is in the variety of raw materials that the rural school has such opportunities. Bark, willow, twigs, clay, wool, fibres, reeds, rush, straw—many of these can be collected from the countryside when they are almost unobtainable in the town. In addition, of course, the rural school has the advantage of being able to collect various plants which, without much equipment or labour, will yield dyes of different colours. (See Section Two, WEAVING AND SPINNING ACTIVITIES.)

These activities cover a very wide field, and some at least of all types can be provided in every school. But it is with these constructive and creative activities that the problem of space emerges. Space is needed for storing the raw materials, for housing the finished or partly finished objects, and for actually doing the work. This is a practical difficulty that has to be solved by each individual school, and unless it is solved the children will be deprived of one of their most important forms of experience and self-expression.

Then there are all those out-of-school activities which fall into the "artistic group" discussed earlier (Chapter II).

The teaching of art has progressed farther than other branches of education in this group. Experiment in different media is essential; hence it is necessary to provide plenty of paint, crayons, pastels, charcoal, oil-paints, finer paints, dyes, coloured paper, coloured wools, coloured materials—in fact anything that can be used to create combinations of colour. Large sheets of paper should also be available, so that extensive masses of colour can be created (see Section One).

Colour experience may be associated, of course, with constructive activities, but in this case the colour is usually predetermined and there is not the scope for creative experience and experiment as can be found in purely colour-making activities. Opportunities for expression through drawing as well as painting are needed, especially for boys.

As in colour, the wider the experience and the greater the opportunities for expression through sound the better. Less provision is made for this than for any other form of artistic activity. This is due partly, of course, to the difficulties that may arise in a classroom if some children are making music while others are occupied with quieter work. Music-making is not any more noisy, however, than the hammering which goes on in constructive activities or in reading aloud; but if a room should be available and can be put on one side for this type of occupation, any difficulty in this direction can be overcome.

A wide variety of music-making materials should be readily available. The materials should be of two kinds: raw materials for the construction of objects with which to make sound, and actual musical instruments. Recently many types of musical instruments have been appearing on the market. Xylophones, zithers, tubular bells, and various wind instruments can be procured relatively cheaply. The drawback

to such instruments is that many are not in tune and they have to be selected with great care and after trial. On such instruments children can make up their own tunes, and with the help of the teacher learn to put them down on paper. In this way the expression of ideas through sound can become as natural as expression through colour or movement or words.

Another aspect of experience in sound lies in producing music and tunes from familiar objects. Bowls, tumblers, wood, metal—all these things will give out notes when tapped lightly with appropriate tools, such as a pencil. Raw materials can be provided with which to make instruments. Strips of wood, for instance, can be turned into a xylophone, metal tubes will make tubular bells, rubber bands stretched across an empty box will make instruments which can be plucked. More difficult, but well within the ability of children of nine or ten, is the making of zithers and small harps by stretching violin strings across cavities of different sizes. Interest in making tunes is present in very young children and only needs stimulating and encouraging to become a live activity at the Junior stage. (See *Projects for the Junior School*, Harrap.)

A third form of music-making is singing and playing together. Little need be said of this, as it is already firmly established in school, except that it seems to appeal particularly to children at the younger end of the Junior School.

Experience of rhythm and expression through rhythm can be associated with a variety of other activities; for example, with sound, movement, form, and number.

Rhythm of sound includes such activities as percussion band and recitation. Both these are generally part of the school programme, and are rarely available as free-choice occupations, but there seems to be a good case for allowing these forms of expression to be available also during free periods. It may be questioned whether percussion should be included in this group of activities at all. It appears, however, to be more closely related to rhythm than to sound. It is true that the different pitches of a drum suggest different notes and the different quality of bells and castanets, for example, is experience in sound, but the essential character of percussion work is in its rhythm rather than in its pitch or quality or tune, and for this reason it has been placed in the rhythm group.

The rhythm of movement brings in various forms of physical activity in which rhythm seems to predominate over mere physical movement, as, for example, in swinging. Dancing, of course, might have been included in this group, but it is so essentially a physical activity that it has been grouped with the physical occupations.

The rhythm of form includes design, in which the rhythm of the pattern is an essential characteristic.

The possibilities of the rhythm of numbers have hardly been explored at all yet in the Junior School. There is much that can be done, however, in connection with tables, series, distribution, and diagrammatic work. (See Vol. III, Arithmetic.)

At the Junior stage it is difficult to isolate *intellectual experience* from other forms of activity. So much learning and thinking are done through practical activities that most of the

work described under physical and constructive and creative experience involves intellectual experience as well. Appreciation of relationships, comparisons and contrasts, and classifications are forms of intellectual experience; so also are imaginative activities and the thought that lies behind the creation of a design or model, even though the thought may not be stated explicitly in words.

Natural situations, handling concrete materials and experiments, stimulate intellectual experience. As the ability to express thoughts in words increases, so the need for the concrete decreases until intellectual experience becomes pure thought. Hence the immense importance of experience in the fields of physical movement, construction and creation, and the interpretation of these experiences in terms of words as a basis for intellectual development. But in addition to the intellectual experience implicit in these activities, three other types of occupation which influence more directly intellectual development should be available. These are concerned with relationships, imaginative occupations, and verbal experience.

The collecting activities of Junior children already described form an important part of this intellectual experience. Classification forms the basis of ideas of relationships and can be extended in school to include numbers, nature, geographical facts, and other forms of knowledge (see Vol. II, HISTORY, and Vol. III, GEOGRAPHY, etc.). It will be noted that arithmetic has a place here as well as in rhythmic experiences, and in fact there is a close connection between rhythmic activities and classification.

The relations aspect of intellectual experience appeals to boys more than to girls. It is in the imaginative activities that girls find their greatest intellectual stimulus. Girls turn freely to imaginative play of all kinds. It is necessary, therefore, to provide both "properties" for dramatic expression and space in which to carry it out. The "properties" may consist of dressing-up clothes for the children themselves to put on, or dolls and puppets which can be made to act. Puppets can be particularly valuable for those children who are shy or self-conscious. They will use puppets for imaginative expression when they would hesitate to do it themselves.

In both these forms of intellectual experience—occupations concerning relationships and imaginative activities—spoken language plays an important part. To these can be added all occupations involving reading. The reading may be connected with finding information about stamps or birds or animals for classification, or it may be for the enjoyment of an imaginative tale, or to find out how a piece of machinery works. Whatever its immediate purpose, its effect is to stimulate ideas and to increase vocabulary.

Keeping records of free activities, putting in writing what has been done, writing to pen friends and expressing ideas in words either spoken or written come naturally to children when language is treated as a natural means of communication. Opportunities should be provided, therefore, for experience in spoken, written, and read language among the other free activities available. This is too often forgotten.

These three classes of experience—physical, practical, and intellectual—are primarily important as means of

satisfying the fundamental needs of children. The fourth class of experience, social experience, is primarily important as a means of adjusting a child to the community.

To play a full part in this community, a child must learn to contribute something *to* the community, to conform to recognized standards of social behaviour, and to become aware of himself as a spiritual being and a spiritual force within the community. To achieve this adjustment, children need to grow up in a social environment in which they can experience these three forms of social relationships.

It is in community life that intercourse and exchange of ideas become of supreme importance. The universal "tools" of intercourse are reading, writing, and speaking, and it is in these so-called "tool subjects" that experience is most urgently needed and most frequently omitted. The purpose of these tools is sometimes lost in the struggle to teach technique. This is the result of introducing technique too soon, before the need for a technique is felt by the children themselves, and before spoken language has become a natural and indispensable means of communication. It is in free activities that language in any of its three forms becomes recognized as a natural means of intercourse.

Those activities which bring together groups of children provide experience in communicating ideas most naturally. In the physical group of activities, therefore, camping and rambling are important, bringing in the use of a vocabulary concerned with nature, camp-craft, and all the attendant fields of experience. Exchange plays an important part as well as language in this type of experience. In this way ideas of value, of the need for food in exchange for either goods or money, of the dependence of a group of people on both one another and on other groups of people become real in a way that no secure home life can ever make real. Written and read language do not enter as naturally into these activities as spoken language, but there are still many opportunities, as in looking up the names of birds or flowers, or consulting a guide-book, or writing home.

In the constructive and creative group of activities we find written and read language taking precedence over spoken. These occupations are essentially individual rather than group in character, hence communication between one member of the class and another is not a necessary feature. On the other hand, it is often necessary to read instructions, especially in the more purely constructive occupations. When children are working together in a group—on some model, for example—spoken language does come in; but apart from this, manipulative activities do not lend themselves to oral work.

Written work can be associated naturally with descriptions of models, but more particularly as a form of creative expression. When children have something to say, they quite naturally turn to writing as a medium of expression. It is only when this form of expression is hemmed in by rules and grammatical laws and hampered by pen and ink that children give up writing and turn to other forms of expression. Most teachers will at some time have come across written work which is quite impossible to decipher, and yet the

child who has written it can read what he has written. Such a child should not be discouraged from this form of expression, even if the adult is unable to decipher his work.

In the group of activities associated with performance, spoken language may play an important part; for example, in shopping and running errands, experience in both understanding spoken instructions and in expressing the result of the performance in words are implicit in the activity.

Among intellectual activities spoken language again takes a prominent place. Take, for example, collecting. The earnest conversations and discussions that take place over "swopping" are immensely valuable as means of expression in words. The corresponding experience of language among girls is associated with their characteristic imaginative games. Here we have the creative use of language leading very naturally to the setting down of conversations on paper.

It is all this experience of language in its three forms, spoken, written, and read, that forms the basis of more formal work in reading, writing, and speech. With this practical experience of the purpose of language and of its place in natural situations, the danger of the mechanics of reading taking precedence over the sense of the matter read is relatively slight. But the provision of books dealing with subjects in which children are really interested is absolutely essential. Hence the need for books dealing with technical matters, with stamps and stamp collecting, with coins, with games; the simple encyclopædia type of book is urgently needed in Junior Schools, books of reference—for example, bird books, books about wild animals, houses in other lands, etc. Then there should be books that tell children how to make things—such as *Weaving and Other Occupations* (Harrap) and *Toy-making in Home and School* (Harrap). In all these children at the Junior stage find the information which really interests them. Variety and quality are needed rather than a few sets of standard books. With such books available, children learn to turn to books for reference and begin to understand their significance and their contribution to the culture of our time.

The artistic group of activities do not present the opportunities that other types of occupation do for experience in language. They are essentially methods of self-expression and means of communication, just as language itself is. Any attempt to describe in words something that has been expressed in colour or form is to force a child into a method of expression that he had not felt able to use. Expression through rhythm in poetry is associated with words, however, and even at the age of six children may use this form of expression freely if they have come to accept language as a natural means of communicating ideas. A small child in a city, for instance, after an evidently happy visit to the country, wrote these lines:

> "*I went to the country and I saw*
> *lovely things;*
> *I saw a butterfly, and it had nice*
> *wings.*"

Here is natural expression through language of an enjoyable experience. A child who had only experienced language through formal reading and writing lessons in the classroom would

never have turned to this method of expressing her ideas.

The idea of exchange can perhaps be included in the experience of intercourse. Exchange may play an important part in children's free activities. It enters into shopping, for instance, and into work with a post-office or railway; it enters into the collecting activities in the form of exchange of specimens for specimens of greater value to the recipient, and so the idea of value gradually emerges. Numerical and mathematical experience can be gained through various types of activity already described. This experience is an essential foundation for the proper understanding of arithmetic and mathematics, and without it the teaching of these subjects will remain unreal.

Intercourse, by whatever means, is only one aspect of social experience. The school setting plays an important part. Children can, of course, contribute something to their own environment in such ways as arranging flowers and keeping the classroom tidy and bright, but most of the responsibility must fall on to the staff. Colour, form, and arrangement all combine to make a material environment which cannot fail to influence the children's standards of appreciation.

Children should also be brought into contact with the creative achievements of some of the great masters of art, music, literature, engineering, sculpture, architecture, and so on. No opportunity of visiting some famous masterpiece should be allowed to slip past. The germ of appreciation is already in children, and it is the teacher's task to see that the environment includes pictures, books, and ornaments worthy of appreciation. It should be the aim of each teacher to provide the best in music and in every field of knowledge and skill as far as is practicable in the educational environment for children.

Children can take an active part in the school organization and government. It is in this direction that they learn to take responsibility and to carry out tasks for the good of the community as a whole. It is these things that make the school setting something more than the mere shell in which the children are taught; they make the school setting in itself an environment for true education.

CHAPTER FIVE

ORGANIZATION FOR FREE ACTIVITIES

IT is through the four different types of experience just described (physical, practical, intellectual, and social), provided in a *controlled* environment, that children can satisfy their needs and learn to adjust themselves to community life.

In the examples of free activities going on in schools it is clear that at any one time children may be enjoying more than one type of experience, and that different children in the same room may not be enjoying the same type of experience.

In the first example, for instance, where seven-year-old children were occupied with various activities of their own choice, each of the four types of experience was in evidence in the room as a whole, but different children were enjoying more than one type.

The boy making Plasticine models was particularly gifted in this form of expression. He was experiencing the satisfaction of the skilful use of his hands, gaining at the purely physical level control of the finer muscles and co-ordination of eye and hand. He was also using Plasticine as a medium for creative expression and constructive experience; in so far, too, as he was expressing his own ideas, he was having intellectual experience in a concrete and practical form, and through his modelling he was gaining experience in artistic expression. He was working entirely by himself, however, and was utterly oblivious of what was going on in other parts of the room.

The children using clay, on the other hand, were working together. They were making different objects and expressing their own individual ideas, but they were working in one another's company and interchange of thought was going on either through conversation or through observation. A certain amount of social intercourse was taking place, therefore, among these children. The little girl working at the big jigsaw was solitary. She was not profiting by the environment around her. A little manipulative skill in putting the pieces in place, a little intellectual activity in determining which piece was needed, was the extent of her occupation; her experience, therefore, was very limited compared with that of the boy making chariots and horses.

The children writing up their diaries were more concerned with writing about what they had done or seen than with the idea of communicating the information to another person. It was a form of creative expression, therefore, rather than a method of intercourse, though at a later stage when the teacher talked to them about their work the children spoke and read what they had written quite freely. The children who were

reading, on the other hand, were making use of written language in a different way. Through their reading their imaginations were stimulated and they were gaining ideas.

In this classroom, therefore, for perhaps the space of an hour there were at least seven different types of occupation going on, covering one form of physical activity, constructive occupations, creative work, intellectual experience through language and creative pursuits, artistic experience through form, and social experience through intercourse and exchange of ideas, and through the sharing of a common interest.

In the classroom where "Home" was the central theme intellectual and social experience predominated. Spoken language was much in evidence, both as a means of intercourse and as a means of creative expression in imaginative play. Written language formed part of the boys' occupations, and was more an intellectual experience than a form of intercourse. A considerable amount of physical experience was evident in the classroom as a whole, partly in moving about the room, due to the nature of the activities, and partly in the form of finer movements connected with sewing.

In the quiet room of the third example, physical experience was reduced to a minimum. One child engaged in sewing was using manipulative skill, but her chief concern was making a colourful design; creative artistic satisfaction was being experienced in her case. Most of the other children were reading or writing. There was little social experience, as nearly all the children were working individually.

On the other hand, social experience was at its height among the ten-year-old girls engaged in household occupations. The tea-party was a social activity at which conversation was of the greatest importance as a means of intercourse. The other two groups of girls were doing individual jobs, but doing them together. Conversation again took place, and its function here was both intellectual and social. Physical and practical activities were also involved, but creative and constructive experience was not in evidence.

The boys interested in the building of houses were having physical and intellectual experience. Spoken and written and read language, used as a means of conveying knowledge, were important in this work. (For other similar projects, see Vol. II, History, and Vol. III, Geography.)

In the class of eight- and nine-year-old children, every form of experience was in evidence. The boys playing tunes on their pipes were making music and enjoying both social and artistic experience in this way. The boys making pipes were engaged in constructive work. They were working individually, and social experience was not greatly in evidence. The girls who had finished dressing their puppets were making them perform, and imaginative work was in progress. Experience of a social set-up was evident among the group who were seeking help from the teacher. Language was important in this connection. The solitary boy playing his pipe was reading music, another form of communication.

From these examples of work going on in various schools it is clear that physical, practical, intellectual, and social experience arise naturally wherever free activities are allowed to develop.

Planning the environment. It is impossible to generalize on how to plan the environment. Each school, each classroom presents particular problems, and each class, each teacher has particular difficulties to overcome, either material or personal. Some suggestions can be put forward, however, which may be some guide in planning and organizing the work.

Fundamentally important is planning for space and movement. It is essential that both children and the teacher should be able to move about the classroom easily. As a rule, the arrangement of desks in serried rows is more extravagant of space than any other plan. It means that space is distributed all over the room in small quantities. A much more convenient plan is to place the desks in the form of three sides of a square. This creates a wide space in the hollow of the square where demonstrations can go on, or where a group of children can dramatize a story. It also leaves enough room for a big table along the fourth wall for any big models. When necessary, too, a lesson can be taken with the whole class without rearranging the furniture, or groups can be taken separately without disturbing other children in the room.

Some teachers prefer to arrange the desks back to back in groups of two or four. This has the advantage of producing big surfaces on which a blackboard can be placed when a flat top is needed. On the other hand, it is not so easy to address the class as a whole, and as a rule it is not so economical of space, the free space being dispersed between the groups of desks rather than concentrated into one area.

But it is not only a question of space; ease of movement is equally important. The room should be so arranged that children can get in and out of their desks without interfering with or disturbing others. It is not even necessary for all the children to be working at desks; the floor is often a more suitable place for large-scale work, and the desks can be left for those using smaller materials.

An important consideration is accessibility of materials. Paints, paper, water, brushes, pastels, scissors, paste, clay—all those raw materials which have been mentioned earlier should be stored in such a way that a child can get them easily without having to ask the teacher or search in a remote corner of a cupboard among a number of things before he can reach what he wants. Inspiration is quickly stifled if its expression has to wait upon the teacher's time. Freedom to act is vital to the spontaneous growth of a piece of work.

Teachers have little control of furniture in school. If a choice is available, however, flat-topped, easily moved furniture should be chosen for free activities. If flat-topped tables or desks are not available, a flat surface can be obtained by putting blackboards over two desks, or the floor of the room can be used. Chairs that can be put on one side are the most suitable form of seating. Children do much of their work standing up, and chairs tend to get in the way.

Storage space is often a difficulty in this kind of work. More space is needed than for the straightforward formal lessons; a greater variety and quantity of materials have to be stored and more and bigger books of the reference kind have to be easily accessible. Reference bookshelves are needed in every room in addition to those in a general

reading-room, if such a room is available.

Organizing the class. There are a variety of ways in which a class can be organized for free activity work, and as in planning the classroom, the actual organization will depend on the children, the teacher, the surroundings, the space available, and a whole host of other factors which can only be dealt with on the spot. There are certain general patterns of organization that can be followed, however, the details depending on the particular conditions in the school.

The easiest organization is to provide materials for three or four types of activity, chosen from the four categories of experience described previously—say constructional work of some kind, painting, reading, and dramatic work. The children can then choose which they would like to do and go straight ahead with their work. This sort of organization keeps the work under control and is a convenient starting-point for inexperienced teachers or for a class that has never experienced freedom in the classroom before. The number of possible activities can be increased as the teacher and children become familiar with the procedure, and eventually the children will be able to have complete freedom of choice within the limits of the materials available. Such an organization is centred in the classroom and limited to the members of the class.

Another possibility is to turn several classrooms into different types of workrooms for certain periods of the day. Again, it is useful to organize in terms of types of experience and have one room provided with what is necessary for experience in artistic fields, for example, another for experience in intellectual pursuits, and so on. With such distribution of materials, the classes themselves would have to disperse, the children going to the room where they would find the sort of activity in which they were interested. Each room, therefore, would contain a cross-section of the whole school (or of those classes which were taking part in the free work), children of different classes and of different ages following their own pursuits in the room. The staff then take charge of what is going on in a room rather than what is being done by a particular class.

From any of these activities an idea may develop which may be pursued by a class or a group in a class, and so the project or topic gets under way.

Another method sometimes followed by teachers is to ask children to bring from home the particular occupation they would like to do during their free periods. This has the advantage of introducing new activities from time to time, and also gives the teacher the opportunity of helping children in their out-of-school occupations.

The teacher's part. One of the most important tasks of the teacher in free activity work is clearly to prepare the educational environment. She has to ensure that there are opportunities for all types of experience, and materials available and sufficiently varied to meet the needs of all the children.

Her second task is to be ready to help when called upon to do so, to guide and encourage, to disclose new avenues of experience when a child seems unable to find them for himself, and she has to listen and to watch.

Her third task is to record. The full value of free activity work can only be

achieved if records are kept of each child's occupations. There are many ways in which this can be done. Sometimes the children themselves keep their own records. Five minutes can be allowed at the end of the period, for example, for the children to jot down what they have done. If activities are limited to a given number and type, the record can be made quickly and easily by the teacher. A useful form is to have a little note-book with the names of the children in the class down one side of the first page, and the occupations along the top of the same page. As many pages as are needed to cover a term's free activity periods (or a year if desirable), allowing a page a period, should then be cut so that both the names and occupations are visible as the pages are turned over. A tick in the appropriate row and column is all that is needed to keep the record up to date.

These records are valuable in two ways. In the first place they give information as to the direction of a child's interests, which is important for any systematic cumulative record making; and, of more immediate value, they show whether a child is having a sufficiently wide variety of experience.

Here, for example, is the case of a boy of between nine and ten years of age. Out of twenty free activity periods he spent fifteen in reading, four in drawing, and was absent on one occasion. His occupations were very limited. Without a complete record and careful observation of this child, it is not possible to say what action, if any, should be taken to widen the extent of his experience.

Another child in the same class spent his twenty periods as follows:

2 in painting.
2 „ drawing.
6 „ stamp collecting.
1 „ Meccano.
1 „ building with bricks.
3 „ making maps.
2 „ raffia work.
1 „ dramatization.
2 „ sticking pictures into a scrap-book.
—
20

Nearly every type of experience is included in this list. It might be necessary in this case to encourage the boy to pursue one occupation a little more persistently.

Two girls in the same class recorded the following activities:

A. 3 periods in clay modelling.
3 „ „ dramatization.
11 „ „ making bead patterns.
3 „ „ sewing.
—
20

B. 4 periods in paper-cutting.
4 „ „ raffia work.
4 „ „ clay modelling.
2 „ „ dramatization.
4 „ „ making bead patterns.
2 „ „ making flowers with coloured wool.
—
20

The extent and variation of occupations shown by these records illustrate again the degree of individual difference that can be expected in any class and the fruitlessness of attempting to teach a class as a whole. It is only when a child is allowed to have experience of the material and human world through personal contact that real understanding of both himself and the world can be acquired and the adjustment of himself to the community in which he has to live can be achieved.